SCIENTIFIC AMERICAN

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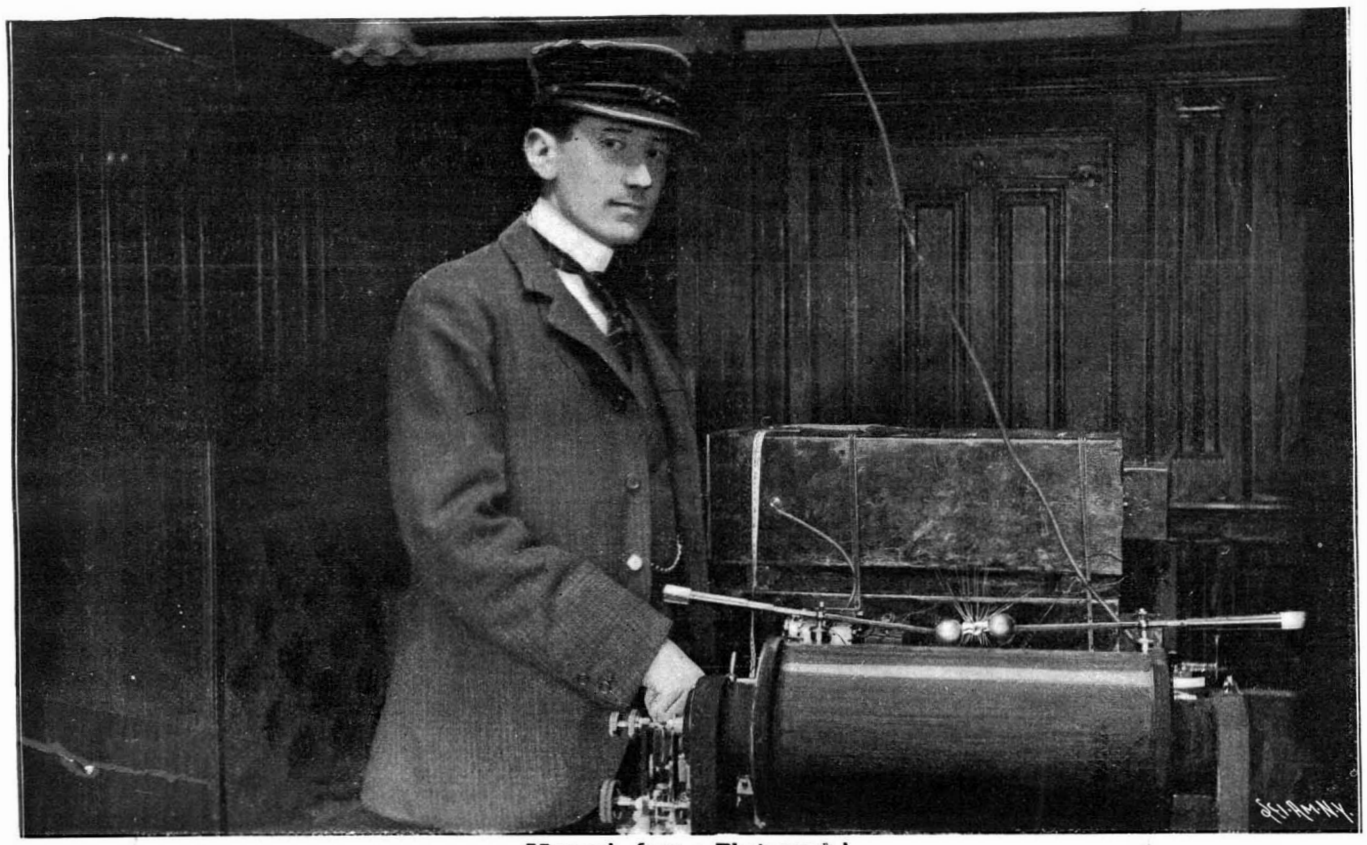
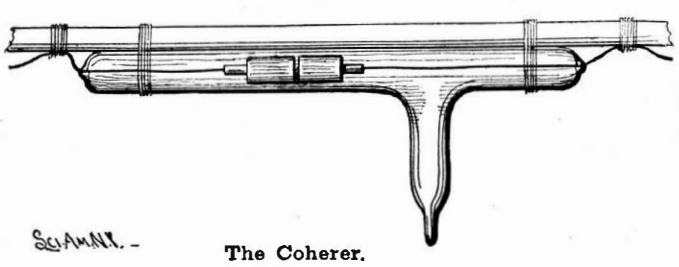


Marconi—from a Photograph.



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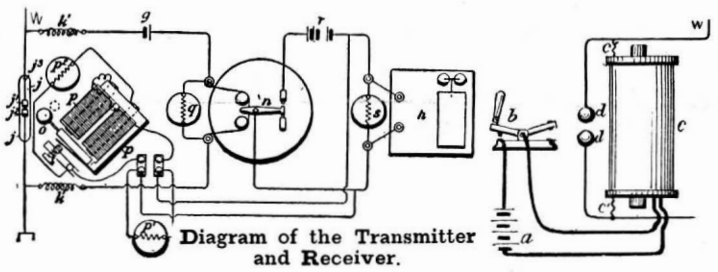
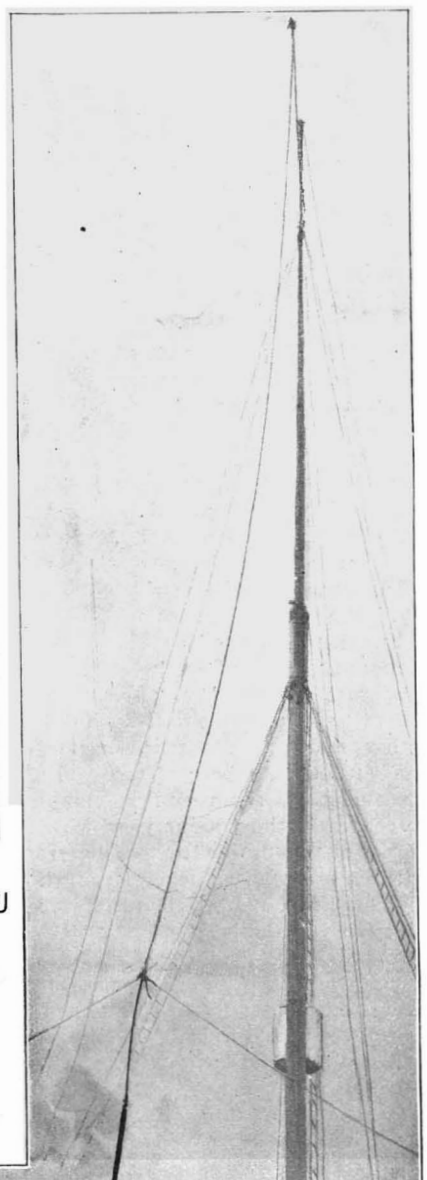
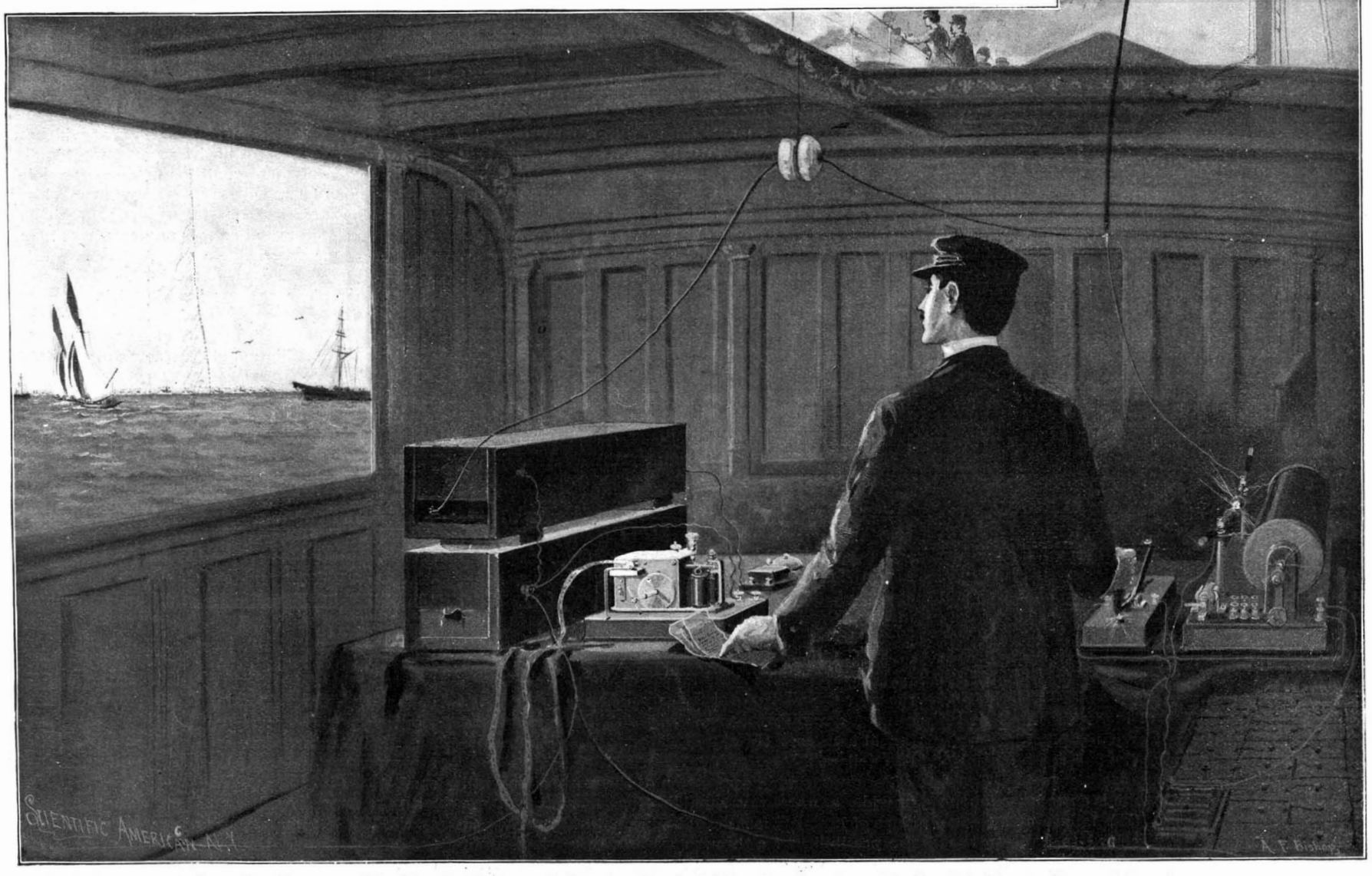


Diagram of the Transmitter and Receiver.





Operating Room on "La Grande Duchesse," Showing Vertical Wire Leading from Masthead to Transmitter and Receiver.

WIRELESS TELEGRAPHY AT THE YACHT RACES.—[See page 279.]

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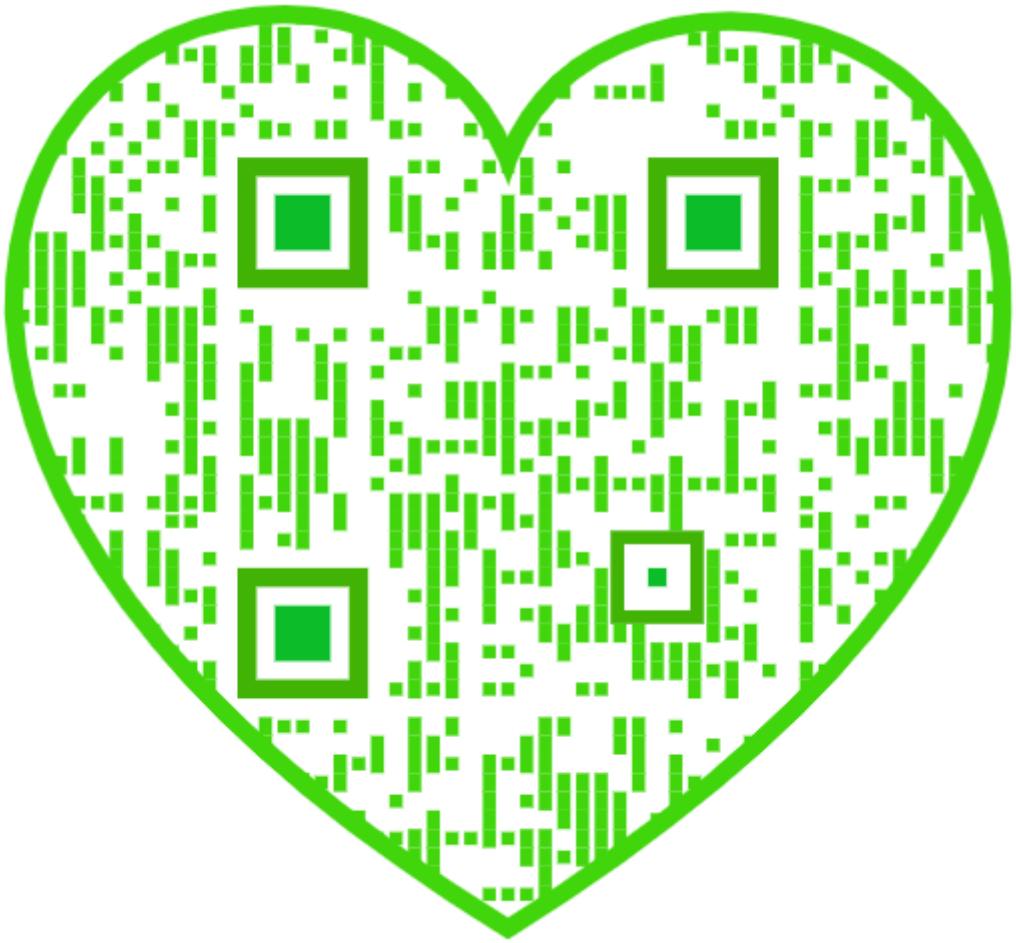

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NEW YORK, SATURDAY, OCTOBER 28, 1899.

ANOTHER SUCCESSFUL DEFENSE OF THE "AMERICA" CUP,

For the tenth time in the history of the "America" Cup have those who build and those who sail our yachts proved that they are well able to guard the historic yachting trophy that was captured nigh upon fifty years ago, in English waters. When we consider how keen is the competition and how narrow is the margin of difference between the competing yachts of the present day, we must admit that in beating the "Shamrock" by 10 minutes and 14 seconds in a light breeze, and by 6 minutes and 34 seconds in a heavy wind, the American boat has, verily, "done herself proud."

Among the axiomatic truths which nobody, with even an elementary knowledge of yacht-sailing, attempts to deny, is the fact that a boat which is weak in her windward work can never be a successful winner of races. No amount of speed to leeward or on reaching can compensate for the heavy loss which is entailed by inability to lie up close to the wind in beating to the weather mark. This truth has been demonstated times without number; it received a most emphatic indorsement in the very first completed "America" Cup contest of the present year, when the marked superiority of "Columbia" over "Shamrock" in windward work in a breeze of sufficient strength to test tbeir real sailing qualities, placed the ultimate issue of the contest beyond all doubt.

The contest between these two fine yachts afforded unusual interest in the earlier stages of the struggle, because of the unexpected light-weather qualities developed by "Shamrock." In the drifting matches which had occurred at the time we last went to press the "Shamrock" had proved her ability to keep very close to "Columbia" in running and reaching, while it was the common opinion of those who watched the boats that in the very light airs which prevailed her work, when close-hauled, was superior to that of the home boat. It evidently needed the test of a fair to strong sailing breeze to bring out the superb qualities of the "Columbia." The first opportunity was given on Monday, October 16, when in a breeze that varied in force from 6 to 12 knots an hour the "Columbia" beat the challenger by 9 minutes and 50 seconds in a fifteen-mile leg to windward and by 24 seconds on the run home before the wind. The yachts had no sooner started on the first leg than it was evident to the veriest amateur that "Shamrock" was unable to lie as close to the wind as "Columbia," there being apparently from three-quarters of a point to a full point of difference between their courses. It was claimed that the difference was due to the English skipper's endeavoring to sail his boat with a "rap full," while "Columbia" was held closer with sheets more fully aboard. As a matter of fact, however, the second race over the windward and leeward course, sailed on Friday, October 20, proved that the fault lay in the boat and not in the skipper, for while "Shamrock" appeared to foot about as fast through the water as "Columbia," she was simply unable to approach her in ability to lie close to the wind.

The defect lies not in the model but in the rig of the English yacht. Her form appears to be about as easy to drive as that of the "Columbia;" for on two occasions in running fifteen miles to windward there has been but little difference between the two boats, and it is probable that had any reaching been included in the trials she would have shown about the same speed as "Columbia." The difference lies in the sail plan and the truth of the matter is that "Columbia" is rigged more in accordance with the latest theories and practice. Her mast is stepped further forward and a larger proportion of her sail area is in her mainsail. Fife, in his endeavor to secure the fine reaching qualities which invariably characterize his yachts, placed more sail in the fore triangle than is customary in the sail plan of other designers. The failure of "Shamrock" in her windward work seemed to indicate that he has carried his ideas too far in this direction.

It will always be a matter of regret that the breaking of the "Shamrock's" topmast shroud, with the consequent loss of her topmast, should have prevented the two boats from having a trial over a triangular course; as this would have given the "Shamrock" an opportunity to show what sne could do on her fastest point of sailing. We do not think that she would have won, for she certainly could not have shown sufficient superiority in twenty miles of reaching to overcome the lead of five to seven minutes which "Columbia" would have established in the ten-mile leg to windward. The decision of the committee that the race should count as one of the series was made in accordance with a stipulation suggested by Sir Thomas Lipton, to the effect that, as the contest this year was largely one between constructors, a breakdown on either vessel should be counted as a win for her opponent.

The third race, because of the splendid wholesale breeze that held true throughout the course, was by far the most exciting of the series. The "Columbia" started about one minute behind the "Shamrock" but overhauled her just before reaching the stake. After the boats had settled down on their first leg to windward, and "Columbia" had commenced to eat into the wind in the old familiar way, the issue was never in doubt for a moment. Her gain to windward was exactly 5 minutes.

We cannot close the subject of the present cup races without some reference to the great popularity achieved by the gentleman who was responsible for the challenger of 1899. Under the extraordinary delays and discouragements which have marked the weather conditions of the past three weeks, and the keen disappointment which must naturally be his on seeing so fine a boat as "Shamrock" defeated, he has borne himself with all those characteristics which mark the true sportsman. Whenever the next challenge comes from the other side, we can imagine no one who would be more welcome to the American people as its sender than Sir Thomas Lipton.

AN ENGINEERING TRIUMPH.

Unless the engineers' plans miscarry, the early days of December next will see the waters of Lake Michigan finding an outlet to the sea by two separate and widely divergent routes; the one being by the natural outlet through the Great Lakes and the St. Lawrence River to the North Atlantic, and the other through an artificial channel connecting the lake by way of the Illinois River with the Mississippi and the waters of the Gulf.

The Chicago drainage canal, as this channel is called, will easily take rank as one of the monumental engineering works of the century. Not only will it form one of the greatest artificial canals in existence, comparing in importance with the ship canals of the world, but as a work of municipal sanitation it is easily the greatest work of its kind ever undertaken. For whatever importance it may assume in the future as a new route to the sea for the waterborne commerce of the lakes, the canal was originally planned as a radical method of solving the problem of sewage disposal for the city of Chicago. It was realized fully a decade and a half ago that the time was approaching when it would no longer be possible to discharge the sewage of this great city into the same source from which it drew its water supply. Vast as is the volume of Lake Michigan it was only a question of time before the polluted waters of the Chicago River would find their way into the intake tunnels through which the water supply of the city was drawn in. However far the intake might be extended into the lake, the polluted stream under the influence of local currents invariably followed, until the problem of some other method of disposal had to be faced.

The plan adopted was at once daring and original It involved the cutting of a great canal twenty-two feet in depth, from 162 to 202 feet wide, and thirty-five miles in length, from Lake Michigan to the Illinois River, a tributary of the Mississippi, and turning the sewage of the city into the vast drainage ditch thus created. In this way the polluted waters would be kept constantly in motion until they were lost in the great volume of the Mississippi itself. By the time it is completed, the work will have involved the excavation of nearly forty million cubic yards of material, of which no less than twelve thousand yards will represent solid rock, the other twenty-eight thousand yards consisting chiefly of glacial drift. The excavation of the canal involved the diversion of the Des Plaines River and the provision of suitable works to control its waters and preserve the integrity of the canal in times of flood. As is invariably the case in works of this character, the actual cost has greatly exceeded the preliminary estimates, and by the time the work is fully completed it will have cost the city of Chicago fully thirty million dollars.

The approaching completion of the work, which will provide a waterway capable of accomodating large ships of 19 and 20 feet draught, has naturally suggested the possibility of a through water way to the Gulf of Mexico by way of the canal, and the Mississippi River. The canal is, of course, much deeper than the Illinois River or the upper reaches of the Mississippi, and to secure even the 14-foot channel proposed would entail a heavy expenditure on the part of the government.

It is natural that the people of Chicago, having in view the enormous development of commerce by way of the lakes and the Welland Canal, should find the prospect of another waterway to the seaboard very alluring, and he would be a bold prophet who at this early stage should deny that it would be a profitable undertaking. The decadence of steamboat traffic on the Mississippi since the development of the great railroad systems is a discouraging feature; but it must be remembered that the opening of a 14-foot waterway from Chicago to New Orleans, would place the question of river traffic on a very different basis from that under which it has made such a losing fight against the railroads.

REAR-ADMIRAL HICHBORN ON THE NEEDS OF THE NAVY.

The annual report of the chief constructor of the navy, Rear-Admiral Hichborn, is of special value as embodying in full the lessons which have been learned from the varied experience of the late Spanish war. Although many valuable data had been gathered at the time of the last report, it was written too soon after the events of the war to enable the volumnious reports furnished by naval officers to be received and fully digested. The present report says: "In response to special orders the bureau has been furnished with a large mass of criticism and comment as to matters under its cognizance. This criticism is the result of the experience under war conditions of seventy-five officers, and covers twenty-five vessels of various classes."

The chief constructor was an early advocate of sheathing as a means of enlarging the strategical and tactical qualities of warships, and the operations of the late contending fleets proved that the advantages of this device have not been over-estimated. The wisdom of Congress in agreeing to the provisions that our newest battleships and cruisers shall be sheathed and coppered is fully confirmed. Another obvious lesson of the war was the necessity for restricting severely the amount of combustible material on board ship, and as a result we learn that during the past year advantage has been taken of the visits of the older ships to the dockyards to improve them both in this respect, and also in the apparatus fitted for fire extinction. While the general attention which has been attracted to the question has resulted in an increase in the number of commercial non-combustible materials, nothing has so far been produced we are told which is more suitable for general purposes than fire-proofed wood.

We learn that the reports which have been turned in by our naval officers confirm the impressions previously arrived at as to the strength, stability, seaworthiness and maneuvering powers of our warships. As to matters of detail, the criticism in the reports naturally centered on such features as were most intimately connected with war service, and which were, under the conditions, severely and thoroughly tested. In this connection it is gratifying to learn with regard to that most important feature, the supply of ammunition to the batteries, that the ammunition hoists, etc., gave very general satisfaction.

The sanitary condition of our ships, as evidenced by the supreme test of the health reports, was found to be in the main satisfactory, although some defects in ventilation must be remedied, especially in the older vessels. The presence of steam pipes in the living quarters of officers and crew is universally condemned; and the favor with which the electrical installations already made have been received, encourages the board to replace steam with electricity as a motive power for the various auxiliaries, as fast as experience warrants. The work already done in this direction includes the installation of 320 electric motors in thirty-six vessels of various classes.

Now, just here we would suggest that although the desire to improve the sanitary condition of our warships is commendable, and the advantages of electricity over steam in cleanliness and in keeping down the temperature between decks are obvious, there is a danger lest in its admiration of the electric auxiliary the bureau should push the substitution too far. For we must remember, that as compared with steam power, electric power is obtained at the cost not merely of increased weight but of a certain amount of power that is lost in the double conversion; and while, considered as a matter of compromise, the weight and power are willingly sacrificed in the case of the manipulation of turrets and ammunition hoists, where perfect control is desirable, we think that for the operation of deck winches, anchor hoists and boat cranes, the steam winch is, perhaps, preferable. No complete substitution of electric for auxiliary steam power would be warranted unless the weights of larger duplicate central combined engines and electric generators, together with the several auxiliary motors, was about the same or slightly less than the aggregate weights of additional boilers and the separate steam engines now used.

Electric motors are especially economical where intermittent power is required at varying intervals, pro-

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vided a constant electric potential available at any moment is maintained.

Other things being equal, it is a question still unsettled whether the weights of an electrical equipment will overbalance a steam auxiliary. It is feared in some quarters that it may, and thereby necessitate sacrifices in such important elements in our ships as speed, armament, and protection. It is supposed that the inefficiency of the proposed new cruisers of the "Denver" class may be due in some measure to the electric auxiliary idea having been pushed too far.

The importance of providing increased docking facilities is emphasized by the fact that not only will the number of battleships in commission be doubled in the near future, but the time is approaching when extensive repairs may be necessary upon the earlier ships. Now, while the completion of the new dry docks will relieve the immediate situation, the present programme does not affect the two most important dockyards, namely those at New York and Norfolk where, in each case, a new dock capable of receiving the largest vessels is urgently needed. The same difficulty is confronting the Navy Department with regard to our rapidly growing fleet of torpedo boats and destroyers, although in this case it is thought that the docking problem can best be met by the construction of marine railways. Torpedo boats, because of their light plating, require frequent inspection of the bottom to detect corrosion. At present it is necessary to dock these diminutive craft in the large dry docks—a manifest waste of time and money, especially when these docks are in urgent demand for the battleships and cruisers.

The report, after emphasizing the need for improved and extended repair facilities at naval stations, closes by calling attention to the need for an enlargement of the corps of naval constructors. It is stated that the amount of work done in the last two years is plainly out of proportion to the number of officers in the corps, and has only been accomplished by overwork on the part of individual officers. We are of the opinion that there is no recommendation in the whole report that demands more immediate attention than this. In spite of the rapid growth of our navy of late years, and especially in the last two years, the total number stands at the old limit of forty, which is all that are allowed by law. Anyone who, like ourselves, was witness of the enormous amount of work taken in hand and successfully put through during the past eighteen months at the Brooklyn navy yard by Constructor Bowles and his assistants, will be prepared for the statement that this important branch of the service is sadly overworked.

THE HEAVENS IN NOVEMBER.

BY GARRETT P. SERVISS.

The expected return of the main body of the November meteors dwarfs every other astronomical event this fall. The splendor of their display, in 1833, made so deep an impression that they have ever since occupied a place apart in the popular imagination as the most gorgeous and startling of all celestial pageants. The fact that three of their periods measure just the span of a century tends to add to their reputation as a spectacle. Although their returns are separated by a space of thirty-three years and a fraction yet they may be seen three times in the course of a man's life. One who saw them as a child, in 1833, might have regarded their fiery menace with the cooler judgment of a middle-aged man in 1866, and, this year, may behold again the scene that marked the start and the turning post of his life with ineffaceable memories of wonders in the heavens.

But, while everybody hopes for a brilliant spectacle on this occasion, there are reasons for anticipating a possible disappointment. In 1866 the display, although imposing, was by no means as wonderful as it had been in 1833. The fact that the meteors were almost as abundant in 1867 as in 1866 showed that they were being scattered along their path. Later investigations indicate that this scattering of the meteors has probably continued ever since. The planet Jupiter, the great perturber of the solar system, has had his hand upon them. They are apparently traveling in several shoals, or parallel streams, and it may be that when the earth crosses their line of march it will fail to pass through any very dense column of the wanderers.

Yet, at the worst, it is certain that there will be a meteoric "shower." There may be only a hundred, or a few hundred, visible in an hour, or there may be many thousands. One unfortunate circumstance will be the presence of a strong moonlight, which will suffice to conceal many small meteors and to rob the larger ones of much of their brilliance. The maximum of the display is generally expected soon after midnight on the morning of November 16, and at that time the moon will be within twenty-eight hours of the full phase. At 1 o'clock A. M., November 16, the moon will be in the constellation Aries, about two hours west of the meridian, while the radiant point of the meteors, in Leo, will be about two hours from its rising point in the northeast.

While the best attainable information points to the first hour of the morning of November 16 as the time when the meteors will be most numerous, yet the data are so uncertain that all observers are advised to be on the watch forty-eight hours earlier. Begin say at midnight on the 13th, and watch until dawn. Resume watching on the following night, and so on until the morning of the 17th. Every watcher for the November meteors on this occasion can have the satisfaction of knowing that his, or her, vigil is being shared, all over the civilized world, by thousands of the brightest spirits, which now inhabit the earth. The solution of the mystery of the November meteors will stand, in the perspective of a thousand years, high among the achievements of man.

The watch for the meteors will inevitably call many unaccustomed eyes to the starry heavens, and luckily the constellations on view include several of the finest. Like the meteors, however, the stars will suffer from the effulgence of the moon. At midnight in the middle of November the eastern half of the firmament is especially beautiful. Nearly overhead glitter the Pleiades, a silvery swarm. A little eastward appears the V-shaped figure of the Hyades, containing the red Aldebaran, marking the eye of the great bull Taurus which the imagination of the constellation makers pictured in the act of charging down upon the giant hunter Orion. The latter appears below the Hyades, toward the southeast, the uplifted "lion's skin," marked by a curving stream of small stars, being interposed between the hunter and the bull. Two brilliant stars, the brighter, Betelgeuse, of an orange tint, being the farther east, mark Orion's broad shoulders. A sparkling group above indicates his head. His beautiful belt, symbolized by three fine stars in a straight row, next catches the eye, while below the belt a splendid lone star, Rigel, shines in the giant's upraised foot.

An imaginary line drawn through the stars of the belt, and continued some twenty degrees toward the left, will point out the brightest star in all the heavens, Sirius, or the Dog Star. Northward from Sirius, and somewhat farther east, shines the lone first-magnitude star, Procyon. Above Procyon, but toward the west, are the twin stars of Gemini, Castor and Pollux. Between Gemini and Taurus flows the Milky Way, which makes its appearance north of Sirius in the east, and, crossing the heavens, disappears when the Northern Cross is setting in the northwest. North of Taurus and in the edge of the Milky Way is the brilliant white star Capellor. West of this is a curved row of stars, in a bright part of the Milky Way, belonging to the constellation Perseus, and below Perseus, also immersed in the Milky Way, is the zigzag figure of Cassiopeia and her chair. Half way down the western sky is the great square of Pegasus, and extending from one corner of the square toward Perseus, is a row of second-magnitude stars belonging to Andraneda, The Great Dipper is low in the northeast, standing on its handle.

THE PLANETS.

The remarkable assemblage of planets in the constellation Libra, to which attention was called in October continues. At the beginning of November Mercury, Venus, Mars, and Jupiter are all in that constellation, while Uranus is about 10° and Saturn about 25° east of its borders. All of these planets are too near the sun for satisfactory observation. Mercury and Venus, however, are moving away from the sun, and on the 16th the former attains its greatest eastern elongation, but it is so far south that it will not be conspicuous as an evening star. Venus will be seen in the southwest after sunset at the end of the month. A notable series of planetary conjunctions begins on the morning of the 4th, when Mercury and Mars meet. On the evening of the 8th Mercury and Uranus are in conjunction. On the morning of the 13th Mars and Uranus are in conjunction, and at noon on the 14th Venus and Uranus. On the forenoon of the 16th there is a conjunction of Venus and Mars, and on the forenoon of the 26th a conjunction of Venus and Mercury. On the afternoon of the 27th Venus meets Saturn, and on the afternoon of the 30th Mercury and Mars are in conjunction for the second time during the month. As these various conjunctions occur while the planets concerned are crossing the astrologically condemned region of Scorpio the high priests of superstition may by expected to make the most of them.

THE MOON.

New moon occurs on the morning of the 3d, first quarter on the morning of the 10th, full moon on the morning of the 17th, and last quarter on the morning of the 25th. The moon is nearest the earth on the forenoon of the 12th, and farthest from the earth on the evening of the 24th.

DEATH OF ADMIRAL COLOMB.

Vice-Admiral Philip Howard Colomb died October 14 at his residence in Botley, Hampshire, England, in the sixty-ninth year of his age. Admiral Colomb was one of the greatest authorities on naval affairs, and especially on the evolutiou of war vessels. He invented and secured the introduction of many of the devices which are now regarded as indispensable in modern warships. His first important invention was a system of flash signals for the British army which was adopted in 1859. In 1867 a system of flash signals for the navy was adopted and it is now used in every navy in the world. His system of interior lighting for warships was invented in 1873 and it is now universally used where the electric light cannot be obtained. He was the author of many professional and popular works.

A NEW ZEALAND VESUVIUS.

For many years visitors touring through New Zealand never thought of leaving that country without first making a pilgrimage to the terraces of the Hot Lake district, about 180 miles distant from Auckland. This wild and curious territory is described by Mr. G. R. Falconer in the last number of The Windsor Magazine.

The white terraces of Rotomahana rose up in a series of twenty platforms in the form of a gigantic stairway. Each terrace was perfectly horizontal and of dazzling whiteness. The top step was vertically 80 feet above the base and sat 300 feet back. From every platform bubbles copious clouds of steam. A stream of boiling water continually flowed from the geysers and as it fell slowly from tier to tier the silicates with which the water was heavily charged became deposited, on its exposure to the air in wonderful lace-work designs of infinite variety and of dazzling whiteness and purity were formed. Not far from the white terrace was another termed the "Pink Terrace" where, owing to some coloring substance in the silicious waters falling from the geysers, the deposits were of a delicate pink hue from which was derived the name "Pink Terrace."

Unfortunately New Zealand no longer possesses this unique spectacle for the terraces are no more. The various agencies of nature which originally built up such curious forms served in turn to destroy them. Mr. Falconer gives a graphic description of the event. He was residing at that time about 40 miles distant from Tarawera. In 1886, on June 10, the night was clear and calm. Heavy rumbling sounds like rolls of distant thunder filled the air but there was no very great alarm. The next day dawned dull and gloomy. About half-past seven o'clock the morning grew darker and light gray ash, very fine, began to fall. He says that although they surmised an eruption was taking place in the Hot Lake district, there were no definite tidings to that effect so that he could only wait to see what would happen. By the aid of a lantern he succeeded in groping his way to the telegraph office, and there he learned that a serious disturbance was taking place at Tarawera and Rotomahana. About eleven o'clock the darkness lifted. All round the ground was covered with a thin filmy pall of fine ash to the depth of half an inch and it was afterward found that the intense darkness was caused by a thick cloud of dust blown out by the volcano to a height so tremendous that it passed above Tauranga and dispersed over the country some miles away.

The manifestation was accompanied by intense cold, the thermometer registering 5 degrees of frost. This is explained by the fact that the columns of steam as they came hissing out of the craters, expanded as they ascended and absorbed their own heat which became latent so that the heat was abstracted from everything near. A day or two later the Government geologist arrived at Tauranga and preparations to inspect the seat of the disaster were pushed rapidly forward. On the fourth day after the eruption, the party arrived at Wairoa the Maori village. There was scarcely a vestige of the settlement to be seen, the whole village had been crushed beneath the volcanic lava and the charred and battered remains of the little village church and other buildings protruded above the surface of the deposit, which at first, measured 4 feet in thickness, but afterward settled down to half that depth. One young Englishman was killed as well as the Maoris who lived in the district and exacted tolls from visitors to the Hot Lakes. The scene was the wildest imaginable. The air rushed over the land with cyclonic fury, uprooting, tearing and breaking trees that had survived the hail of rocks leaving here and there a gnarled and jagged trunk denuded of branches and stripped of its bark.

The next day the party set off for Rotomahana. As they approached the Hot Lakes huge cracks extending hundreds of yards in length and about a foot in width were seen in all directions. The scene was one of the strange grandeur of absolute desolation. The upheaval of nature had blown the wonderful terraces to atoms; steam was rising in dense clouds from one end of the area to the other, a distance of about nine miles. Rotomahana Lake was a yawning caldron from which rose a majestic column of steam. The ground was completely stripped of vegetation and covered with lava from the mountain. The lava was reduced to the consistency of flour so that the explorers sank in it nearly to their knees. Thus in the space of time was North Island suddenly shorn of its most peculiar natural features. In six hours the whole aspect of the country was changed, and what was one of the most beautiful spots in the world was transformed into a barren country carpeted in lava and covered with débris. The geysers, however, still abound in profusion, and it is possible in time other terraces may be formed.

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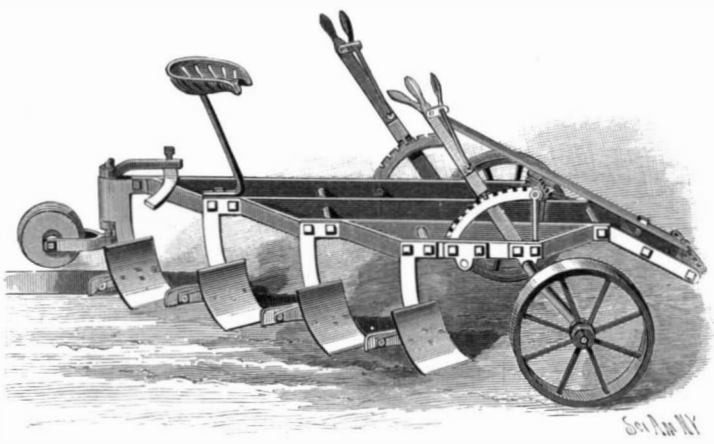
A NEW GANG OR CULTIVATOR PLOW.

Our illustration represents a novel cultivator plow which has been patented by John T. Lucas, of Wasco, Ore., and which is chararacterized by the use of a rear guide-wheel having but slight frictional engagement with the land, and by the use of mechanism for raising and lowering all the shares simultaneously and for leveling the plow.

The body of the plow is composed of two side beams and two projecting intermediate beams. The right-hand side beam is bent to form a series of steps, to which rectangular shares, concaved on their forward faces, convexed on their rear faces, are bolted. One or more shares are provided with landsides.

The landsides prevent the shares from slipping upon



A NEW GANG OR CULTIVATOR PLOW.

hilly ground ; and their shape is such that much of the friction usually met with is avoided. The shares and landsides are especially adapted to three-wheeled plows, the draft being considerably reduced by reason of the small pressure between the land and the bottom of the shares and their landsides.

The rear share differs from the others, in having an integral sleeve which receives a vertical shaft carrying at its lower end a fork in which a beveled guide wheel is journaled. A forwardly extended arm is attached to the shaft, moves over a guide to the right, and is prevented from moving toward the land by a pin with which it engages. The guide-wheel, therefore, requires no attention and need not be operated by hand.

At the front end of the plow a clevis of angular construction is arranged. One member of the clevis is adapted to travel laterally ; while the other member is provided with a series of apertures adapted to receive a draft device. The clevis is laterally shifted through the medium of a hand-lever to vary the drat to and from the land when the plow is in motion.

The plow-frame is provided with separate, parallel axles, formed with crank-arms by which the supporting-wheels are carried. A lever is connected with each axle. By means of the lever at the left of the frame and attached to the rear axle, the shares can be raised and lowered ; and by means of the left-hand lever the wheel which travels in the furrow can be raised independently of the landside wheel, so as to level the plow.

SEVERAL prominent railroad men have given a number of cars to be used for religious work, and they are described in a recent number of The Railway Review. The cars are 80 feet long and there is a 50-foot chapel capable of seating a hundred people. They are kept in repair and go through the shops for paint and varnish whenever needed. They are met with almost universal favor by the officials of the railways and they are always given free transportation over any line. The car is really a parsonage, church, choir and chapel combined. A distribution of bibles, tracts and religious newspapers is made among the railroad men and people in destitute places. The cars are enabled to make calls at small towns which are long distances away from the nearest church. The chapel car is specially welcome at the car shops. The pulpit is at one end of the car and the audience is seated as in the ordinary day coach.

A FOUR-SPINDLE HORIZONTAL CAR-BORING MACHINE.

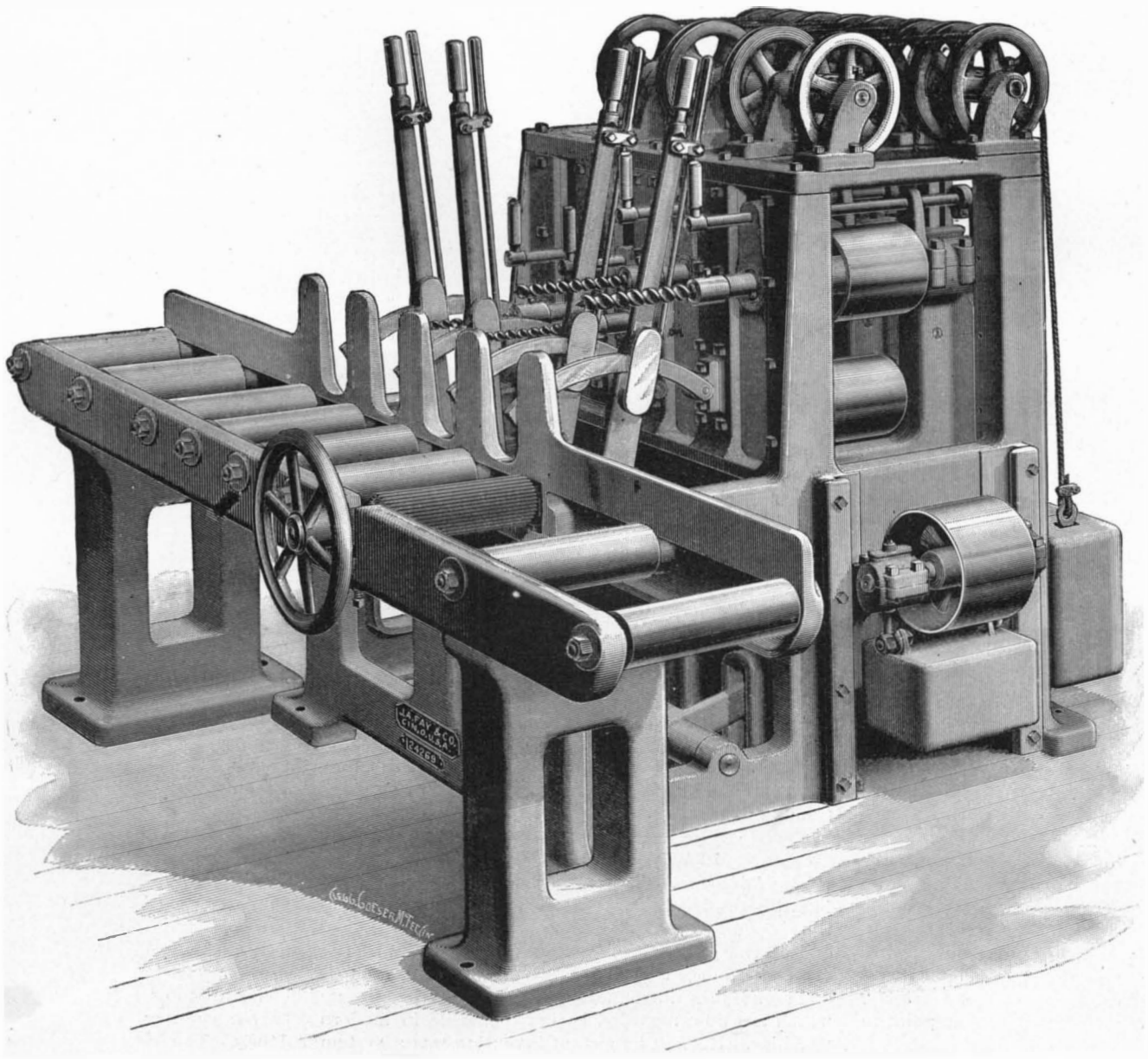
A machine has been constructed by the J. A. Fay Company, 10 to 30 John Street, Cincinnati, Ohio, which is designed to overcome the difficulties met with in operating the car-borers used in the construction and repairing of railway and street cars, agricultural implements, and heavy wagons. In this new machine the driving or belt power of the boring spindles has been so improved that the capacity in boring holes of large diameter has been considerably increased.

The working parts of the machine are all supported by a heavy cored column.

The boring spindles are $1\frac{1}{16}$ inches in diameter and are double key-seated. They have a vertical movement of 13 inches controlled by adjusting levers, and a transverse movement of 16 inches. Abundant belt power is provided for boring holes 3 inches in diameter. The spindle pulleys are 7 inches in diameter by $7\frac{1}{2}$ inches space. The spindles run in heavy self-oiling bearings of gun metal.

For each of the spindle frames there are four gibs whereby the wear is readily taken up. These frames are rigidly supported at top and bottom, are counterweighted, giving them an easy vertical movement, and are adjusted by levers having an automatic locking device consisting of a double-eccentric working against a guide that grips with increasing force when the strain is applied. The spindles are driven by one belt properly adjusted in tension by an automatic sliding tightener. The table is 8 feet long by 15 inches wide, and is supported on two heavy cored stands; its sides are strongly ribbed and carry nine friction rollers, one of which is fluted, and provided with a hand wheel and with a vertical adjustment. The fence on the back of the table has a high support on each side of the boring bits.

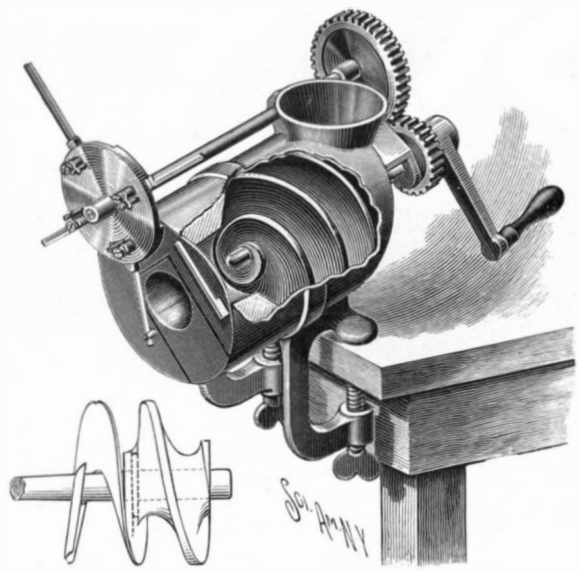
On the top of the frame are two sets of sheave pulleys giving a direct vertical pull on the spindle frame and avoiding any binding. Counterweights on the back have rollers which reduce the friction on the sides of the frame.



A FOUR-SPINDLE HORIZONTAL CAR-BORING MACHINE.

A MECHANICAL BUTTER MOULDER AND CUTTER.

In restaurants and hotels it is customary to form butter into small pats or disks of such size as to answer for one person. A machine, by means of which such pats can be quickly produced, has been invented by



A MECHANICAL BUTTER MOULDER AND CUTTER.

Leopold Linkiewicz, of 176 Graham Avenue, Brooklyn, New York city. The machine comprises an inclined barrel or chamber formed in two parts fastened together by a pin and bayonet-slot connection. One end of the barrel has a hopper for the reception of the butter, and the other end has a discharge opening. Within the barrel a crank-operated spiral is mounted, which is connected by gearing with a shaft journaled above the spiral. The spiral is composed of two parts, one of which is made of wood, and the other of which is composed of a flat plate of spring metal secured by one end to the wooden part, being otherwise unsupported, so that it can be compressed during its rotation by engagement with the sloping end surface of the barrel. The butter is, therefore, compressed and forced toward the wooden screw portion and issues from the discharge opening in a bar of cross-section corresponding with the shape of the opening. The form of this cross-section can be changed by the employment of slides with variously-shaped openings. The shaft above the spiral carries at the discharge end of the barrel a disk on which spring-held knives are pivoted, sweeping past the discharge opening. A pin on the barrel engages the outer ends of the knives to retard them just before passing the discharge opening, so that the butter is cut by a quick, sharp blow. On the side of the discharge opening opposite the pin, a knife-clearer is secured which serves to clean the knives as they sweep around. Butter-pats having variously-formed surfaces can be produced by the use of special knives.

THE government of New Zealand now sends communications by carrier pigeons between Auckland and Great Barrier Island, a distance across the water of 30 miles. The service is controlled by the Post Office Department, and the fee for a single message is one shilling and a stamp for this amount has to be bought at the Post Office.

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An Emerald Craze in Colombia.

United States Minister C. B. Hart writes: "Until very recently emeralds were a drug on the market of Bogota. One who desired to buy them had only to wait and have them brought to him. The famous Muzo Mine, which has produced emeralds of great value and in large quantities, lies near Bogota, and the people of this city had long been familiar with its products. This mine is operated by a French company, which insists that for the past year or so it has found almost no emeralds. However, from this source, or from some other, crude emeralds have continued to come into Bogata. Of the cut stones, set and unset, there has been an abundance in the market. Hard times have compelled many persons to offer for the sale their higly prized heirlooms, and these have been obtainable, as a rule, at very low prices. In July an emerald craze seized upon Bogota. The jewelry stores and all other establishments where emeralds are dealt in were besieged by persons who wished to buy, and by others who wished to sell; and for the same reason, men and women crowded the streets, standing in the roadway as well as on the sidewalk, some displaying their emeralds and others their money. A jewelry establishment located on the most prominent corner in Bogota was compelled to ask the police to drive the crowd away.

"As the news spread outside of Bogota, emerald owners began to rush in. This swelled the throng and sent the fever up several degrees. Sales were made right and left, at prices hitherto unheard of in this market. Persons who had not thought of selling, tempted by the wild rush to buy, brought out their emeralds and began trading. Nobody could explain the real cause of the excitement, and many are now beginning to realize that it was without real cause. In a few days the fever reached its height and began to decline. While it lasted emeralds sold, on a gold basis, at about three times their value in this market just before the excitement began. It is estimated that up to this time about 4,000,000 pesos have changed hands as the result of the furor.

"The crowd soon disappeared from the streets, and many buyers who went in on the flood tide find themselves with emeralds that will not bring the price they paid for them. Others, also inexperienced, have more or less excellent imitations as souvenirs of this extraordinary movement. It does not appear that the expert dealers have bought so extravagantly as the general public, and yet it is believed that some of these have far overreached themselves.

"The only approach to an explanation for this craze is that a Bogota dealer who went to Paris recently, on his return to this city began to buy emeralds at higher prices than had been ruling in the market. This seems to have started it. Some of the experts say that this dealer drew out of the market long before prices reached their height, and that he did so because emeralds were selling in Bogota for more than they would bring in Europe."

A RACING AUTOMOBILE.

In Paris it has become quite the fashion to have automobile races covering long distances, and manufacturers build special machines for this purpose. The prevalence of good roads in France favors this sort of sport. But in this country, the road conditions as a rule, are against automobile racing, though the era of the bicycle has done much to effect road improvement.

Our illustration of a special racing gasoline propelled Winton machine showing, Mr. Winton's hand on the driving lever, has been built extra heavy to withstand the strains liable to be put upon it by reason of rough roads, and also to enable it to travel at a speed of twenty-eight miles an hour, where possible. It will be noticed that acetylene dash lamps are on the front, and also the signal horn midway between them. It is equipped with a seven horse power Winton engine and is expected to do the work intended for it very easily. The vehicle is to be used in making a time record between Chicago and New York sometime this fall.

A Pneumatic Letter Copying Book.

A novelty is a pneumatic letter-copying book. The device is intended particularly for the use of travelers who cannot have access to a press. The book is similar to an ordinary copy book in general appearance and is provided with clasps to hold the covers firmly and furnish resistance to internal air pressure. The leaves are moistened in the usual way with a brush or sponge, or damp cloth, and the book is closed and clasped and the air bag is pumped up by means of a bulb. The pressure is even and good copies can be obtained by its use.

A PORTABLE ACETYLENE GAS LAMP.

A new acetylene gas lamp has been invented by Peter Josserand, of Josserand, Tex., which is particularly adapted for use as a table-lamp, and which is arranged to insure a uniform, perfect, and brilliant light.

The lamp comprises a base supporting a bowl forming a generator in which the calcium carbide is contained and in which gas is generated. A cap screws on the generator and terminates in a pipe by which a water-reservoir is supported. A tube provided at its upper end with a burner, extends through the reservoir and serves to conduct the gas. Water is supplied from the reservoir to the generator below by means of a pipe provided with an automatic valve. As shown in our enlarged detail view this valve has a downwardly extending stem fitting loosely in the end of the water pipe, and an upwardly-extending stem receiving the end of a rod screwed in a cap closing the valve-chamber. The screw-rod is provided with a collar engaged at its lower end by a spring coiled around the stem. A tube opening into the valve-chamber above the valve, conducts the water to the generator.

THE JOSSERAND ACETYLENE-LAMP.

When the screw-rod is screwed down, the valve is seated to cut off the water supply, but when the rod is screwed out until the collar abuts against the under side of the cap so as to allow the spring to hold the valve loosely to its seat, then the water rises in the valve chamber and flows drop by drop to the generator. When the gas pressure overbalances the water pressure, the valve is seated, thus preventing the further generation of gas. When the gas pressure has diminished, the valve is opened by the water and generation is resumed.

The supply of carbide can be replenished by unscrewing the generator cap and placing the required quantity of the material within the bowl. The water reservoir can be filled by means of a filling cap.

British Consular Reports.

Feilden's Magazine laments the inadequacy of the British Consul Reports which are issued without notice at uncertain intervals, and which are mostly prepared by men who have not had the advantage of any commercial experience. The reports are sold and with few exceptions are quite useless either in consequence of the incompetency of the authors or from the great delay in their publication, rendering the information out of date. Of late, instead of giving information which might possibly be of value they consist, for the most part of reproving homilies addressed to British manufacturers on the subject of their failings. A properly organized commercial section is now a necessity to the government of a manufacturing country. This is shown by both Germany and the United States whose consular service in trade respects is very superior. The American Consular Reports are issued daily and are sent to all newspapers who will use them. The Consular page in the SCIENTIFIC AMERICAN SUPPLEMENT, which is published weekly, gives an excellent idea of the value of these reports.

On the Blue Color of Water.

In an article that appeared in No. 1, Vol. XVIII, of the Receuil des Travaux Chimiques des Pays-bas et de la Belgique, W. Spring again discusses the questions as to the cause of the blue color of water. Many physicists have regarded the blue color of the sea and of lakes as not belonging to the water itself, but as being produced by the reflection of the sunlight from invisible particles which the water always contains in suspension. This idea was suggested by the theory then held regarding the cause of the blue color of the sky. Earlier experiments of Spring led him to the conclusion that water itself is blue, and that the fine particles which it holds in suspension, while contributing very much to its illumination, exert no appreciable influence on the intensity of the blue color. Soret had previously, in 1869, expressed this same opinion. As neither the work of Soret nor that of Spring appears to have convinced everyone, Spring has again taken up the subject with the object of determining experimentally the optical properties of the particles in clear waters, parallel rays from a powerful electric light were passed through (1) distilled water, (2) the drinking water of Liege, and (3) rain water that had been allowed to stand. In all cases the presence of particles became apparent, the clearest being the drinking water. There was no evidence of a blue water. Now four experiments were performed.

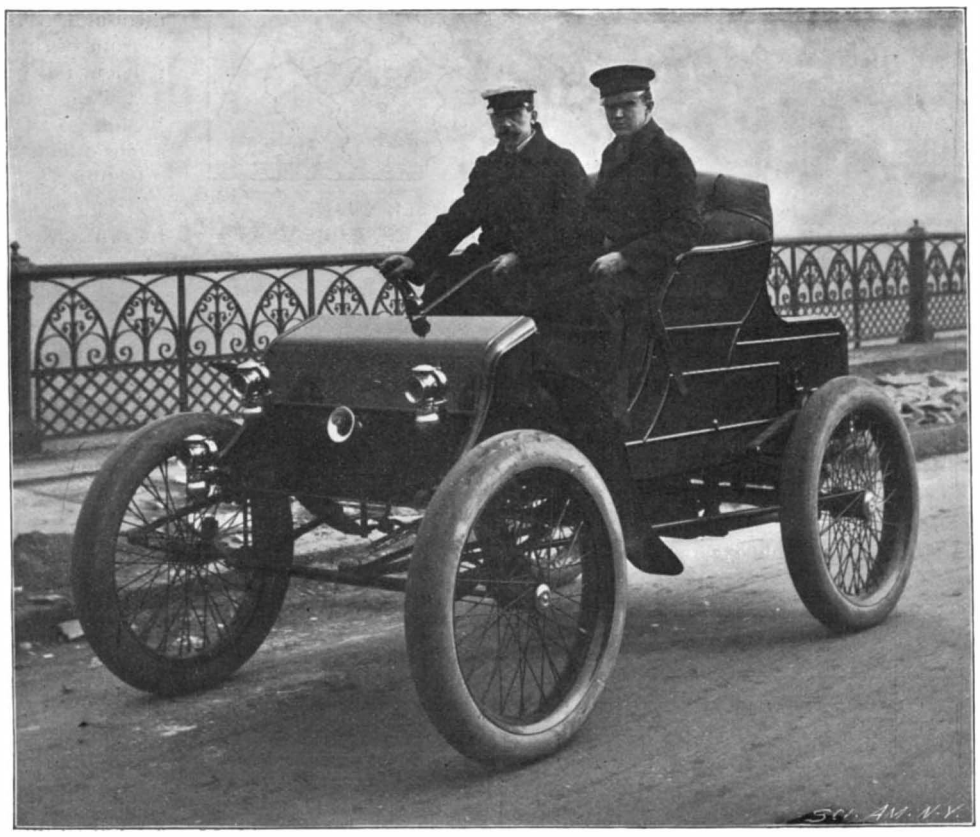
1. A cell containing a solution of magenta was interposed between the source of light and the tube containing the water, so that only red light passed through the latter. Under these conditions the light appeared red and its intensity was not diminished.

2. The light was passed through a solution of picric acid before it was passed through the water. The yellow light was not in the least modified by being passed through the water.

3. The water was illuminated by blue light produced by interposing a cell containing an ammoniacal solution of cupric hydrate or a piece of cobalt glass. The result was the same as in the first two experiments. The color was not changed by passing the light through the water.

4. Green light produced by passing it through a solution of nickel chloride gave the same results, that is to say, the color was not changed.

These experiments show that the particles, to which clear water, distilled of natural, owes its illumination, have the power to reflect the red, the yellow and the green waves, and that they cannot, therefore, be the cause of the blue color of water. Reflecting with equal facility waves of all lengths, they return the sunlight to us without chromatic change. The author concludes that water is blue of itself, and that the particles which it holds in suspension are the principle cause of its illumination. According to their nature, they determine also the modification of the color of the water, and produce greenish tones when they do not destroy all the natural color.—Am. Chem. Jour.



THE WINTON RACING VEHICLE.

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Correspondence.

Some Calendarial Facts.

To the Editor of the Scientific American:

The following corrections should be made in my article entitled "Some Calendarial Facts About the Twentieth Century," printed in your issue of September 23, 1899:

In the third paragraph, line three, "twenty-four" should be "twenty-five"; line twelve, 1968 should take the place of 1969; lines seventeen and eighteen, instead of 1906, 1928, 1956, 1984, respectively, read 1902, 1924, 1952, 1980. In the next to the last paragraph, lines fifteen and sixteen, "wholly" and "only partially" should exchange places. Benjamin F. Yanney.

Mount Union College, Alliance, Ohio.

The Yacht "America."

To the Editor of the Scientific American:

The interest taken in everything pertaining to the international yacht races is my excuse for calling attention to certain facts in regard to the old "America," which are not generally known. Many pictures of her have been recently published showing her original rig with a single topmast and one large jib. While this was the rig that she actually used, the appearance of the pictures is not at all like the boat herself. When she made her famous race her masts had an amount of rake very much greater than is ever seen at the present day and more than her masts had afterward. At the time of her race a plumb bob dropped from the masthead would strike her taffrail. A reference to the London Illustrated News of 1851, of a date a week or two later than the races, will confirm this statement.

There was another remarkable feature in the "America" in her original form which has not received notice, and in some of the engravings which have been published showing the longitudinal section, grave mistakes have been made. She had a sternpost of unusual length and great rake. Her draught of water forward was said to be in the neighborhood of one-half what it was at the sternpost, and it was generally understood that she was modeled in what the old designers used to call a drag line. That was that the water lines as laid down were inclined to the true water line and were lower at the stern than at the bow.

The boat was purchased by an Englishman not long after the races in 1851, and in accordance with English ideas the rake was taken out of the masts by giving them new steps and she was ballasted so as to bring her more nearly on even keel. This change of rig and ballast took the speed out of her and she was no longer able to work to windward as before. Indeed she could not lie nearly as close to the wind as with the raking masts. When she fell into the hands of the United States government, her masts were very much nearer a vertical than they were originally and have remained so until the present time. The possibilities are that if they were given the original angle of rake she would be a very much better boat than she is at present, although when going free or "winged out" there would be difficulty with the booms coming home, a fault which all vessels with raking masts encounter.

One of the peculiarities which greatly impressed all English writers when she made her appearance in British waters in 1851, was that her sails were as "flat as boards" and that they were laced to the booms at the foot. This was a great novelty, as the old English idea was to allow the sail to belly so as to contain as much wind as possible, the thought being that the quantity of wind contained in the sail in some way increased the driving power. In a recent interview, Mr. Ratsey makes mention of the fact that he, with his father, visited the "America" in 1851 and studied her rig and the cut of her sails very closely. If the descriptions of the latest Herreshoff sails are true, he has been returning to English practice while Mr. Ratsey has followed as closely as possible the example set by the "America." The photographs of the two boats seem to bear out this idea. Most of them show the "Shamrock" with sails much flatter than those of the "Columbia."

In this connection, one of the most valuable things for the racing public would be to obtain descriptions of the experiments tried years ago by Mr. Stevens in regard to the relative value of different rigs. These have been alluded to several times within the last year, but only in a very general way. Tradition has it that he built boats of large size as nearly identical as possible and then rigged them in different ways and raced them against each other, changing crews from one to the other, and then to make the equality perfect, changing rigs and beginning a new set of races in which crews again exchanged boats. It would, at least, be interesting to know the speed obtained by the boats in his day and how close they could sail to the wind. The older men seem to think that the "America's" speed has been very greatly reduced by the modifications which have taken place in her rig, and that she would be fast at the present day by the side of anything except a racing machine. W. E. Partridge.

Philadelphia, October 13, 1899.

Control of the San Juan River at Greytown.

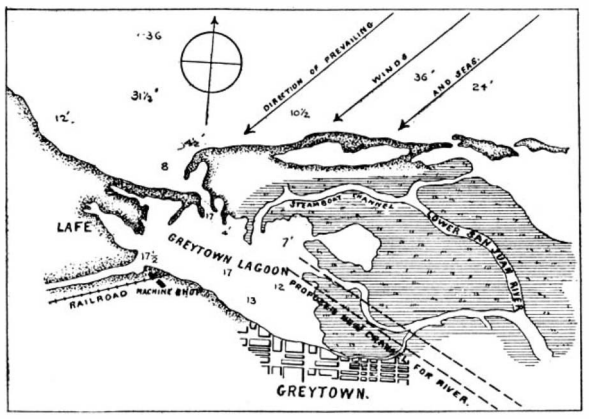
To the Editor of the Scientific American:

It is true that the approaching completion of the Panama Canal raises a question for serious consideration whether it is wise for the United States to begin another, for the same purpose, at this time.

But it can only be a question of time—one railroad across our continent was once thought sufficient, and it will do no harm to discuss, for future need, the physical questions involved.

Your correspondent wishes to offer his mite concerning the obstructions in Greytown harbor, the eastern terminus of the proposed Nicaragua Canal, described and illustrated so handsomely in your issue of February 18.

Reproductions of the plates of the harbor in 1832 and 1895, and that of the delta of the San Juan, together with statistics quoted from this article, show clearly the cause of the trouble. Silt, discharged into the sea through the delta, is swept along the coast by currents produced by the trade winds, and finding repose



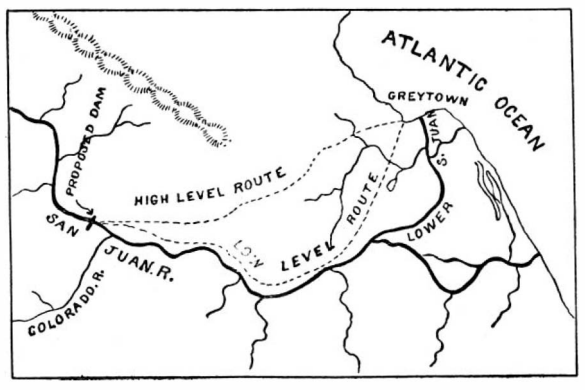
MAP OF GREYTOWN HARBOR, SHOWING PROPOSED NEW CHANNEL FOR THE SAN JUAN RIVER.

in the pocket forming the harbor of Greytown, it has accumulated there for ages.

But, before proceeding to discuss a remedy, we must glance at surrounding conditions. Lake Nicaragua, through which the route passes, has an area of 3,000 square miles, a drainage basin of 12,000,000 square miles, and an annual rainfall of 256 inches, or about 21 feet.

The San Juan River, the outlet of the lake, is 120 miles in length, has a minimum discharge in the dry season of 12,000 cubic feet per second, with a maximum discharge in the rainy season of 60,000 cubic feet per second, according to some authorities, and 150,000 cubic feet per second according to others, the latter figures representing a volume equal to two-thirds of the average flow over Niagara Falls; and the silt brought down to the sea, annually, is estimated at 600,000 cubic yards.

It is obvious that no jetty can be built in the harbor which will not be outflanked by this silt so long as it



THE DELTA OF THE SAN JUAN.

is turned loose to windward. But why allow this? Keep it in the river, and make the river clean out the harbor.

Levee in, for twenty-five or thirty miles, the branch of the delta known as the lower San Juan Coast, with an approach to the harbor ranging with the east, as represented by dotted lines on the plates, the material for the levees of this approach to be taken from a central trench, to guide the flow in its incipiency, and let this be done during one dry season. As soon as possible in the beginning of the next dry season dike up all outlets except the new one, so that the new channel will be partially cut before the floods come, and then let the river do the rest.

During one wet season the concentrated flow of this mighty torrent would open a channel deep enough for any craft afloat, not only to Greytown, but to points many miles above, making it possible to shorten the canal to that extent if the low level route is adopted, or, if the high level route is selected, deep water would be brought to its terminus. And in this long stretch of river well sheltered anchorage would be found for unlimited numbers of ships.

The silt, we must remember, would no longer move along the coast outside, but would now be suspended in the river current, from which it could not be dropped in the form of a bar, until the velocity of this current was assisted by impinging upon still water. But instead of impinging upon still water the river current would form a junction with the outside current at an acute angle, by which the silt would be carried on and distributed along the coast beyond, rendering the formation of a bar impossible.

To appreciate how peculiarly well the San Juan is adapted to the service proposed, we must glance at what occurs in other large rivers. In the Mississippi, for instance, there is a never-ending supply of silt from its head waters to the sea, one flood rolls this load along the bottom a certain distance and then drops it for the next flood to take up. In all parts and in all seasons the bottom is thus encumbered.

But in the San Juan conditions are entirely different. The silt of the upper drainage basin goes into the lake and stays there, leaving only that of the river and its lateral tributaries below the lake to find its way to the sea. Under the enormous rainfall of that locality, Lake Nicaragua becomes a huge standpipe from which great volumes of uncharged water pour, long after the lateral tributaries of the river have ceased bringing down solid matter. This afterflow then sweeps out the silt left in the river's bed, and, as no more is coming in, the bottom is thoroughly cleaned; and the same result would be obtained in the harbor's bed when the river is concentrated upon it.

This action will be enhanced by the structures of the canal, for a dam would be placed on the river about half way down, making slack water back to the lake. This would cut off all silt in the river above the dam, and lessen by one-half the distance to be cleaned out below.

The cost of constructing a harbor at Greytown is estimated at $2,500,000 by one authority and at $9,500,000 by another. One-half of the lesser estimate would be in excess of what would be required by the plan proposed, and keeping up the levees would be the only cost afterward. William W. Blackford.

Lynnhaven, Princess Anne County, Va., September 20, 1899.

Army Transport Service.

To the Editor of the Scientific American:

Will you kindly give answer to the following naval questions in your esteemed journal?

1. The navy department is supposed to be in great need of a certain class of vessels for Philippine service.

The "Columbia" and "Minneapolis" are not in commission at the present time, although it would seem that in these two splendid ships the navy possesses a pair of cruisers extraordinarily well adapted to the particular needs of the Philippine work. They are economical ships under one screw and capable of the highest speed when necessary. They are of fairly light draught and carry a large complement available for duty in cutters and launches about the coast inlets, etc., and it is possible to give them extra large complements of marines for shore duty. It is even possible to use them for moderate troopship service, among the islands where a battalion of infantry must frequently be needed for quick transportation over short distances. They are also probably the "coolest" ships in the navy for tropical service. It would be interesting to know why two such excellent vessels, possessing qualities that are in great demand at the Philippine Islands just now are kept tied up at a navy yard dock, although it is of course understood, that there are reasons of some sort not generally known outside the efficient navy department.

2. The New York papers state that the rebuilt "Chicago" has no electric illuminating plant. This seems queer. Is it not incorrect? Reader.

October 11, 1899.

[1. The "Minneapolis" and "Columbia" would not be suitable for the service proposed by our correspondent. These ships require an enormous complement to run them, and this is one of the chief reasons for their being laid up. At a time like the present, when officers are so badly needed, better results are obtained by having the same number of officers and men serve on several smaller boats of lighter draught, and the policy of the Navy Department is to place in commission few of the larger and more of the smaller boats. When larger ships are used in the Philippines, it is desirable to send out completely armored vessels such as the "Brooklyn" and "Oregon." Moreover, the large complement of officers and men necessary for the "Minneapolis" and "Columbia" leaves but little room on these ships for transport service; indeed they possess few qualities that could not be found on merchant ships of the same size that would have a large capacity as troopships.

2. The statement that the "Chicago" has no electric illuminating plant is absolutely untrue.—Ed.]

The specific inductive capacity of gutta percha is 2·46, of rubber 2·34, of paper nearly unity. The average capacity of a telephone cable should be 0·080.

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WIRELESS TELEGRAPHY AT THE YACHT RACES.

In a recent issue we described the arrangements made by The New York Herald, for reporting the international yacht races by the Marconi system of wireless telegraphy. The earlier races, or attempted races, were reported from the steamship "Ponce," and the later races from the steamship "La Grande Duchesse," which was sent out under the joint auspices of the Plant Line and The Marine Journal, of this city. By the courtesy of The Herald and Captain Geo. L. Norton, the editor of The Marine Journal, our artist was enabled to accompany Marconi and make the sketches of the installation on the "Duchesse" which appear on the front page of this issue.

AETHERIC TELEGRAPHY.—If we place in the primary circuit of an ordinary induction coil a Morse key, and arrange the secondary circuit to end in a radiator composed of two metallic spheres, or two capacity areas, every time the key is depressed and a spark passes between the spheres, electro-magnetic waves of enormously high frequency will be thrown out through the ether from the spheres or capacity areas in every direction. These electric waves are transmitted through space in exactly the same way as light. Their existence was suggested by Maxwell, and Hertz by his brilliant experiments succeeded in detecting their presence and measuring them. Hence, they are known as the Hertzian waves.

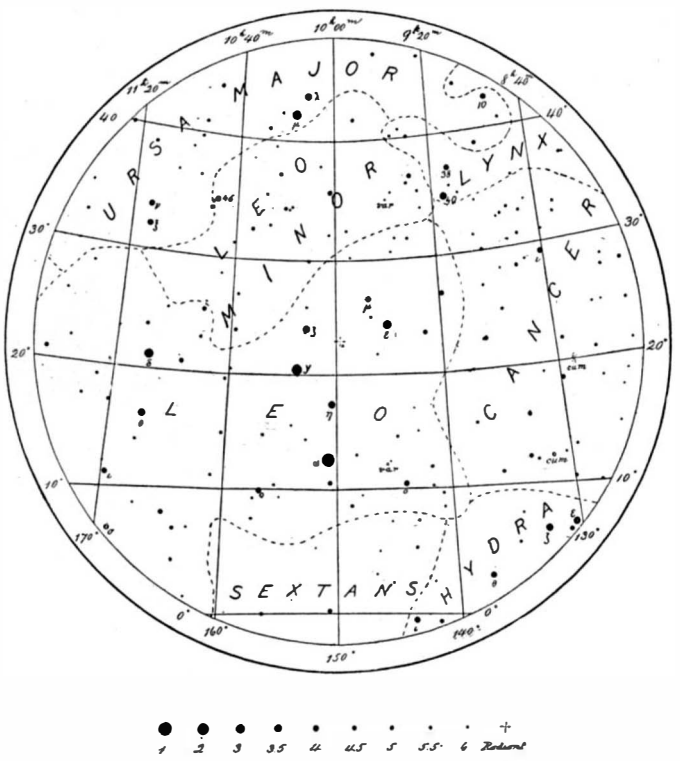
Now, since they are flung out into space as often and as long as the Morse key is depressed, it was evident that if a suitable receiver and recorder could be devised, these electro magnetic waves would lend themselves to the transmission of ordinary dot and dash telegraph messages, the ether taking the place of the cable as a medium of transmission. Such a receiver was discovered by Prof. Calzecchi Onesti, of Fermo, and after modifications by Branly, Lodge, and others, was brought to its present perfection by Marconi. The receiver consists essentially of a small glass tube called the coherer, about 1½ inches in length, into the ends of which are inserted two silver pole pieces, which fit the tube, but whose ends are about $\frac{1}{50}$ inch apart. The space between the ends is filled with a mixture composed of fine nickel and silver filings and a mere trace of mercury, and the other ends of the pole pieces are attached to the wires of a local circuit. In the normal condition the metallic filings have an enormous resistance, and constitute a practical insulator, preventing the flow of the local current; but if they are influenced by electric waves, coherence takes place and the resistance falls, allowing the local current to pass. The coherence will continue until the filings are mechanically shaken, when they will at once fall apart, as it were, insulation will be established, and the current will be broken. If, then a coherer be brought within the influence of the electric waves thrown out from a transmitter, coherence will occur whenever the key of the transmitter at the distant station is depressed. Mr. Marconi has devised an ingenious arrangement, in which a small hammer is made to rap continuously upon the coherer by the action of the local circuit which is closed when the Hertzian waves pass through the metal filings. As soon as the waves cease, the hammer gives its last rap and the tube is left in the decohered condition ready for the next transmission of waves. It is evident that by making the local circuit operate a relay, in the circuit of which is a standard recording instrument, the messages may be recorded on a tape in the usual way.

In addition to the valuable work that Marconi has done in perfecting the coherer and rendering it amenable to the practical manipulation of the Morse code, it must be understood that by introducing the vertical wire he has added an absolutely essential feature to successful wireless telegraphy. He has not only demonstrated that it is essential to the sending and receiving of messages over long distances, but he has formulated the law which governs the relation between the height of the wire and the distance at which its outflowing waves may be received and recorded. This he has ascertained to vary as the square of the vertical height of the wire, measured from the top of the wire to the level of the transmitter and receiver below.

The method of sending the reports of the yacht races was as follows: The foremast of the "Grande Duchesse" carried an auxiliary mast of sufficient length to give the desired vertical height of 120 feet to a wire, which reached from a short yard on the mast to the table of the operating room below, on which the sending and receiving apparatus was placed. A similar wire was suspended from the foremast of the Bennett-Mackay cable steamer, which was anchored near the Sandy Hook lightship, the starting and finishing point of the races, and also from a mast at the Navesink Highlands. The cable ship and the Highlands had temporary cable connections with New York. The "Grande Duchesse" accompanied the yachts over the course, and the momentary details of the race, as observed from her decks, were flashed to the cable ship, from which they were sent over the cable to New York, and thence telegraphed throughout the world. Thus was London practically enabled to keep its eyes upon the competing yachts as they covered the course.

One of our illustrations, which is reproduced from an excellent photograph of the inventor, shows Marconi with his hand upon the transmitter. The other illustration shows the vertical wire leading down from the masthead through the skylight to connect with the transmitter and the receiver in the operating room. The transmitter is on the right hand side of the table, and the receiver is in one of the rectangular boxes on the left. The recorder, on which a message from the cable steamer at Sandy Hook is being printed, stands on the table near Marconi's left hand. It should be explained that each rectangular box contains a complete receiver, one being in reserve in case of accident. Through the window of the operating room may be seen the Sandy Hook lightship, with "Shamrock" and "Columbia" in the act of crossing the line.

To assist our readers to a clearer understanding of the Marconi apparatus, we have included the small diagrams shown on the front page, of which the following is a description: The letters, *d*, *d*, indicate the spheres of the transmitter, which are connected, one to the vertical wire, *w*, the other to earth, and both by wires, c^1c^1, to the terminals of the secondary winding of induction coil, *c*. In the primary circuit is the key, *b*. The coherer, *j*, has two metal pole pieces, j^1j^2, separated by silver and nickel filings. One end of the tube is connected to earth, the other to the vertical wire, *w*, and the coherer itself forms part of a circuit containing the local cell, *g*, and a sensitive telegraph relay actuating another circuit, which circuit works a trembler, *p*, of which *o* is the decohering tapper or hammer. When the electric waves pass from *w* to j^1j^2 the resistance falls, and the current from *g* actuates the relay, *n*, the choking coils, k^1k^1, lying between the coherer and the relay, compelling the electric waves to traverse the coherer instead of flowing through the relay. The relay, *n*, in its turn, causes the more powerful battery, *r*, to pass a current through the tapper, and also through the electromagnet of the recording instrument, *h*.



REGION OF METEORS.

The alternate cohering by the waves and decohering by the tapper continues uninterruptedly as long as the transmitting key at the distant station is depressed. The armature of the recording instrument, however, because of its inertia, cannot rise and fall in unison with the rapid coherence and decoherence of the receiver, and hence it remains down and makes a stroke upon the tape as long as the sending key is depressed. Hence, applying this description to the present case, our readers will understand that by the manipulation of the sending key on the "Grande Duchesse," the operator was able to produce the dot and dash characters of the Morse code on the tape of the recording instrument on the Bennett-Mackay many miles distant from the competing yachts.

Such is the Marconi system, as successfully operated for the first time in this country. Using the same methods, the distinguished inventor has transmitted messages between ships of the British navy that were separated by eighty miles of water; and, more remarkable yet, he has sent messages successfully from Chelmsford, in England, to Boulogne, in France, a distance of 110 miles. On this occasion the curvature of the earth amounted to over one thousand feet.

DEPOSITS of alluvial or placer copper from the White River country of Alaska has been sent to Chicago. This nugget is of pure metal and weighs 147 pounds.

THE NOVEMBER METEORS OF 1899.

BY PROF. E. C. PICKERING.

The predicted time of maximum of the November meteors is November 15, 1899, at 18 h. Greenwich mean time. As a similar shower may not occur again for thirty years, no pains should be spared to secure the best possible observations. The most useful observations that can be made by amateurs are those which will serve to determine the number of meteors visible per hour throughout the entire duration of the shower. They should be made on November 15, and also on the two preceding and following evenings. The most important time for observation is from midnight until dawn, as comparatively few meteors are expected earlier. Observations are particularly needed at hours when they cannot be made at the observatories of Europe and America. In general, the time required for ten or more meteors to appear in the region covered by the accompanying map, should be recorded. This observation should be repeated every hour or half hour. If the meteors are too numerous to count all those appearing upon the map, the observer should confine his attention exclusively to some small region such as that included between the stars μ Ursae Majoris, 40 Lyncis, δ and α Leonis. If the meteors occur but seldom, one every five minutes, for instance, the time and class of each meteor should be recorded, Also note the time during which the sky was watched and no meteors seen, and the time during which that portion of the sky was obscured by clouds. Passing clouds or haze, during the time of observation should also be recorded. The date should be the astronomical day, beginning at noon, that is, the date of early morning observations should be that of the preceding evening. Specify what time is used, as Greenwich, standard, or local time. When a meteor bursts, make a second observation of its light and color, and when it leaves a trail, record the motion of the latter by charting the neighboring stars, and sketching its position among them at short intervals until it disappears, noting the time of each observation. If the path of a meteor is surely curved, record it carefully upon the map.

On November 14, 1898, thirty-four photographs were obtained of eleven different meteors. Their discussion has led to results of unexpected value. The greatest number of meteors photographed by one instrument was five. Only two meteors were photographed which passed outside of the region covered by the map, although the total region covered was three or four times as great. No meteors fainter than the second magnitude were photographed.

Photographs may be taken, first, by leaving the camera at rest, when the images of the stars will trail over the plate and appear as lines, or secondly, attaching the camera to an equatorial telescope moved by clockwork, when a chart of the sky will be formed, in which the stars will appear as points. A rapid-rectilinear lens is to be preferred in the first case, a wide-angle lens in the second. The full aperture should be used, and as large a plate as can be covered. The most rapid plates are best for this work; they should be changed once an hour, and the exact times of starting and stopping recorded. Care should be taken to stiffen the camera by braces, so that the focus will not be changed when the instrument is pointed to different portions of the sky, especially if the lens is heavy. If the first method is employed, the position of the camera should be changed after each plate, so as to include as much as possible of the region of the map on each photograph. If pointed a little southeast of ε Leonis, the radiant will reach the center of the field about the middle af the exposure. A watch of the region should also be kept, and the exact time of appearance and path of each meteor as bright as the Pole Star should be recorded. The plates should be numbered on the film side with a pencil, and should be sent to the Harvard Observatory with accompanying notes and other observations. After measurement there, they will be returned if desired. The value of the results will be much increased if similar photographs can be obtained by a second camera from ten to forty miles distant, and preferably north or south of the other.

Harvard College Observatory.

THE Indiana State Geologist in his annual report says that during the last five years pipe lines have been extending toward the heart of the natural gas field. Until now the center is less than 150 square miles. All the gas producing rock is now more or less intimately connected, and whatever tends to reduce the supply in one part of the field has the same effect on all parts. This is shown by a remarkable reduction in pressure In three years the pressure sank from 264 to 181 pounds and the average pressure at which a well has to be abandoned is between 130 and 150 pounds. Petroleum will probably replace the gas in the greater portion of the rock and while it lasts can be used as fuel, but the supply like that of natural gas is limited.

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SOME HARBORS AND PIERS OF SOUTHERN CALIFORNIA.

BY CHARLES F. HOLDER.

Among what may be called the mechanical developments of Southern California the remarkable pier, built by the Southern Pacific Company, at Port Los Angeles stands out as perhaps the most interesting. A glance at the coast line of Southern California will show that it is lacking in harbors below San Francisco, and in five hundred miles there are but two perfect harbors, one at San Diego, the other at Catalina Harbor at the island of that name. The latter is small, but more protected than any on the coast. It lies on the west side of the island and would not be noticed until its entrance was reached, the opening being a cut in the mountains that front the west coast, the harbor then extending in between lofty hills and cutting the island almost in two; in fact, there is good reason to believe that in former days there were two islands here, the narrow passage being filled up.

So peculiar is the harbor that it has caused great speculation among those who have observed it. It reaches in half a mile, has water deep enough to float the navies of the world. At its head a short walk brings one to a protected bay on the opposite side of the island where a town is being laid out and by August, of 1900, will have in all probability, a summer population of several thousand.

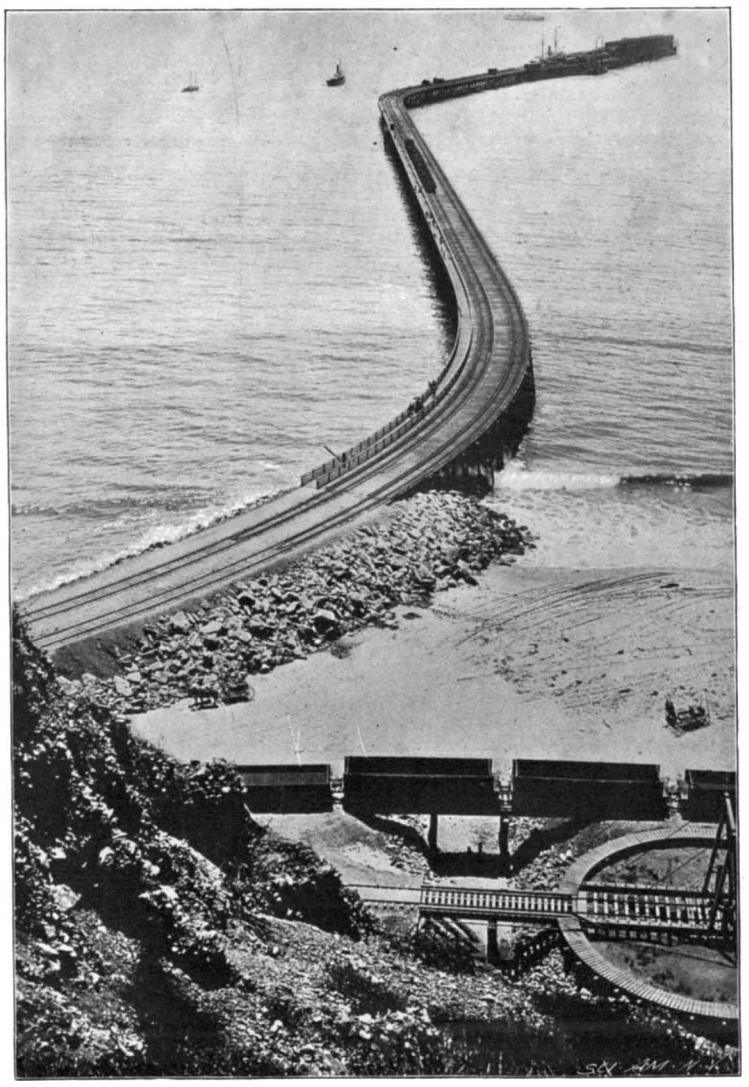
In the large harbor there is an extraordinary neck of land that reaches out like a terminal moraine, made up of large and small rocks and shaped in such graceful lines that the impression is conveyed that it is the work of man. From an examination it appears to have been formed by a heavy sea which could have tossed the rocks so high above water; yet the bottom around the peculiar curve or spit is devoid of rocks. This breakwater forms a second complete harbor for small boats.

The harbor of San Diego is as perfect as could be desired, the entrance being between lofty headlands on one side and Coronado on the south; then turning to the south it extends several miles, affording perfect protection, Coronado beach lying between it and the open sea.

Between San Diego and San Francisco are the harbors of Newport, San Pedro, Redondo, Santa Monica, Huinieme, San Louis Obispo, all these, with the exception of San Pedro, are open roadsteads, affording little or no protection from gales that blow directly in. San Pedro, in Wilmington Harbor, has a long, narrow cut, lined with wharves, into which large vessels are towed but large men-of-war could not enter. It is evident, then, the southern coast is lamentably deficient in protected harbors in the vicinity of Los Angeles, the great railroad center. To remedy this, attempts have been made from time to time to obtain a permanent appropriation and various commissioners have examined the coast and reported in favor of San Pedro. The contract has finally been awarded and the work is being carried on, rock being taken from quarries at Santa Catalina Island twenty miles distant. The Southern Pacific was a pioneer in this movement and though it held the key to the situation at San Pedro as the best protection for its wharves and tracks, it was believed that Santa Monica was the better location, the principal argument being that Los Angeles was naturally growing in that direction and that it would never grow toward Wilmington on account of certain geographical conditions.

Confident in the belief that its experts were right the Southern Pacific Company determined to have a harbor at Santa Monica. A location was selected north of the town and a pier begun which probably has not its equal in the world; and to this spot, which the company has named Port Los Angeles, it is bringing all its commerce, and the result will be, in all probability, that Southern California will have two protected harbors instead of one.

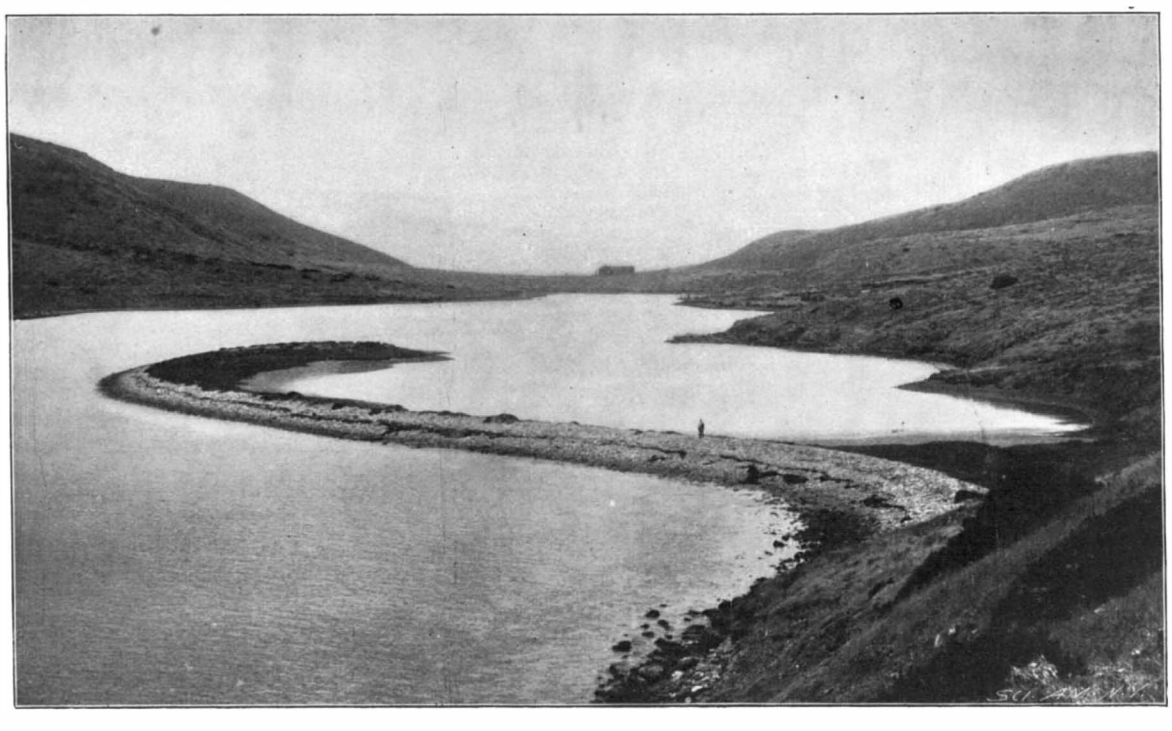
From the mesa of Port Los Angeles the great pier resembles a huge snake reaching out over the water and turning to the right, terminating a mile from the shore, and beyond the breakers which eternally pound upon the sands. The great wharf is a most interesting structure looked at from any point of view, and it has already become an important factor when the commercial development of Southern California is considered. Approaching it the observer is impressed with the solidity of the work. The approach is 3,120 feet in length, and 28 feet in width, the length of the entire pier is 4,720 feet. The material employed in such a structure and the amount of money expended are enormous. A wooden structure of any kind subjected to the ocean in California is very expensive on account of two natural enemies, the teredo and limnoria; the first a mollusk that bores into the wood, grinding and piercing it, replacing the space with its limy tube; and to such an extent do these animals work that they will in a few months completely honeycomb a section of wood so that it becomes a mere shell. Even more of a menace is the limnoria, a minute crustacean that eats the wood, boring a small hole about the size of a knitting needle and completely perforating it. So rapidly do these animals work that the life of a pile protected in the bay of Avalon is not more than three years, the combined efforts of the small enemies of man thus quickly destroying its usefulness.



GREAT PIER AT PORT LOS ANGELES.

In making the approach to the Santa Monica wharf 1,500 piles were used; 975,000 feet of lumber and 37 tons of bolts and spikes to hold it together. The main wharf is 1,600 feet in length, 130 feet and 6 inches wide. In its construction there was used 3,700 piles, each of which had been treated to creosote as a protection against the teredo and limnoria; even this is not a perfect protection, the little animals forcing their way in in time. Besides these, 1,300,000 feet of plain lumber was used and 50 tons of iron; in addition to this are 300,000 feet of 8 by 8 lumber as braces above high water mark and 30 tons of rods and bolts, the sea being very heavy here during a storm.

On this main portion of the wharf there are seven parallel railway tracks, made of the heaviest steel rails. There is also a huge coal bunker 817 feet long, 30 feet high, with a storage capacity of 10,000 tons. Another large building on the pier is the depot offices, etc., 384 feet in length, so that when the number of men and employees are considered there is a little village in itself on this pier out to sea. The wharf is built in gradually deepening water until at the termination there is from 32 to 34 feet at low tide, the fall being nearly 6 feet.



THE ISTHMUS, CATALINA ISLAND.

The Origin of the Newspaper.

In the Leipzig Daheim, Ernst Niemann has an exceptionally interesting study of the origin of the newspaper, says The Nation. The well-known Acta Diurna in Rome in the time of Cæsar has no historical connection whatever with latter-day newspaperdom. Modern journalism is not of Roman but chiefly of Germanic origin. In fact, what are now newspapers are really only developments of a kind of circulating letters which, as early as the fourteenth and fifteenth centuries, passed between business houses principally in the interests of trade. These "Zeitungen," or "Tidinge," were written but not printed. In the greater centers of population were found men who made it their occupation to send out these reports, usually to business houses, but often also to political and other authorities. Of the famous Fugger Zeitung, twenty-eight volumes are preserved in the University library at Heidelberg. These written circular letters, both "ordinari" and "extraordinari," as occasion required, became almost a regular institution as the postal system became generally introduced. Probably the strangest thing in connection with the history of journalism is the fact that it was exceedingly slow to make use of the art of printing for its purposes. Indeed, almost the whole sixteenth century had passed before this innovation was thought of, although, during the Reformation period, questions of public prominence were brought before the people in countless tracts, pamphlets, etc., often with illustrations, but never in the shape of a regularly printed periodical.

The transition to this stage was caused by the publication in 1583 of the Relatio Historica by Michael von Aitzing, of Cologne, the success of whose printed account of a Cologne church controversy first suggested the idea of publishing every sixth month, at the time of the Frankfort Messe, a general report of the news. This undertaking soon stimulated rival enterprises. Niemann is convinced that all efforts to deny to the Germans the honor of having originated the modern newspaper must fail in the light of unprejudiced historical research. The oldest venture of this kind, however, is not, as has been generally supposed, the Frankfort Journal, but a certain Relation, which appeared probably in Strassburg, and fifty-two numbers of which dating from the year 1609, are still found in Heidelberg. The Journal was not published till 1615, the first English paper, the Weekly News, in 1622, and the first French journal in 1630.

OUR consul, Albion W. Tourgée, of Bordeaux, suggests that it would be advisable for exporters to let the consuls know something about the success or failure of the enterprises in which they engage in their districts. As it is now, they write asking information about dealers, opportunities, etc. The consul writes many letters to get the information the exporters want, and tells them what they must do and then hears nothing more from them.

CEMENT is used in France to protect iron railway bridges from the fumes of the locomotives.

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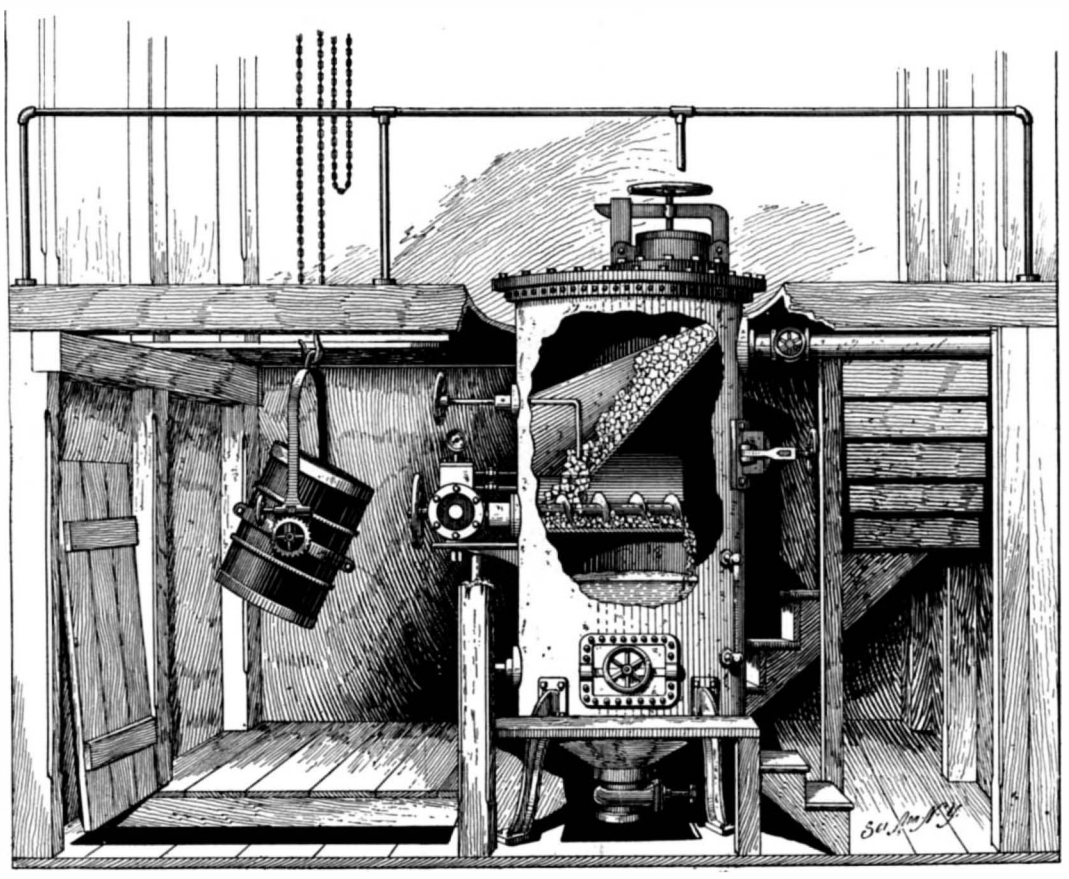
DESTRUCTION OF THE CITY ACETYLENE GAS PLANT AT WABASH, IND.

Wabash, Ind., a beautiful city of 13,000 inhabitants, situated on the banks of the Wabash River, is celebrated especially for its progressive spirit in municipal lighting. It was the first city in the United States to be lighted by electricity, and now it is the pioneer in the use of acetylene gas. The largest acetylene installation in the world was here erected and the new gas, giving such a powerful and brilliant light, is distributed through a system of street mains under the same conditions as ordinary coal gas. It may here be said that Indiana is well in the van in appreciating the possibilities of acetylene, and isolated plants are being installed in many of the smaller cities and towns. Dana, Ind., is another city, the business portion of which is lighted by this means.

Last fall a portion of the mains in Wabash, then used for conveying naphtha gas, were disconnected, and through these acetylene gas was distributed to a portion of the business houses. This practical test through the winter months proved satisfactory both to the company and the consumers as well. The gas gave a steady white flame, much more brilliant than the incandescent electric lamps, or the naphtha gas, even with the Welsbach burners, and proved to be entirely free from odor, soot and smoke. During the trial period and subsequently, the plant has been so managed that the supply to the city has not been interrupted even momentarily, thus demonstrating its reliability and that the design of acetylene generators is so far advanced as to insure a steady and constant supply of gas.

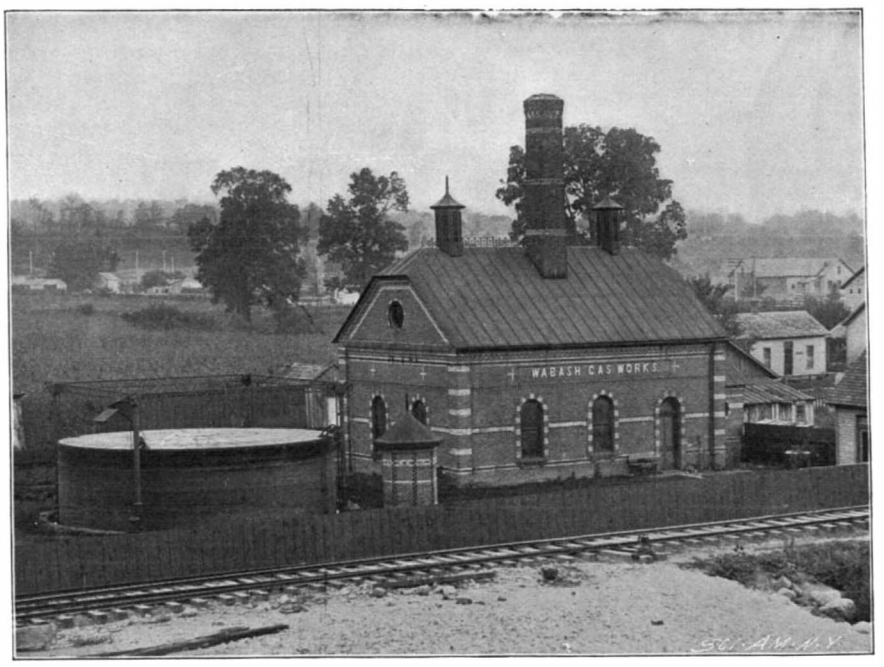
This spring the present plant was installed and acetylene has since been used to the exclusion of other gas. The gas is stored in a tank of 6,000 cubic feet capacity and the distribution is effected in the usual manner. From the generator the gas is led through a 4-inch pipe to a relief holder of 200 cubic feet capacity which equalized the pressure for the station meter, and from thence it passes into the large storage tank.



GENERATOR, PARTLY IN SECTION.

The general arrangement of the generator and structure is shown in the sectional view. The Williamson improved type C generator is designed on the "wet" process principle, i. e., the calcium carbide is small and measured quantities is dropped into a large volume of water. The shell of the generator is 8 feet 6 inches in height, 3 feet 6 inches in diameter, made of $\frac{5}{8}$-inch boiler plate, and was tested to 60 pounds pressure per square inch. About half of this shell contains water which is maintained at a constant level by means of a siphon, and in the upper portion is an iron hopper capable of holding 1,100 pounds of carbide. A water motor is attached to the shell by means of a bracket, and this operates a screw conveyor which draws the carbide from the hopper and precipitates it into the water beneath. The water motor exhausts into the generator and maintains a water supply for gas generation.

The operation of the plant is very simple and requires a minimum of attention. A large bucket containing 1,100 pounds of carbide is raised to the top of the generator by a chain block and the carbide dumped through a door at the top of the generator into the hopper. The door is then closed and clamped upon a rubber gasket, making a gas-tight joint. When the water motor is started the carbide is dropped into the large body of water, sinks to the bottom, and immediately the gas is evolved. The gas, bubbling through 4 feet of water, is washed clean of dust and solid matter, and the lime in the water enters into chemical union with the sulphur and other impurities which may be in the carbide. The residue which accumulates at the bottom in a slimy gray mass is drawn off by opening a 6-inch gate valve and passes into a receptacle beneath. The interior of the generator can be thoroughly cleansed by washing with water and access may be had to the inside through a manhole. A recent test showed that with the exhaust water from the motor at 40° F. the maximum temperature in the generator was 84° F., thus demonstrating that the gas is delivered cool and pure.



THE WABASH, IND., ACETYLENE GAS PLANT BEFORE THE EXPLOSION.

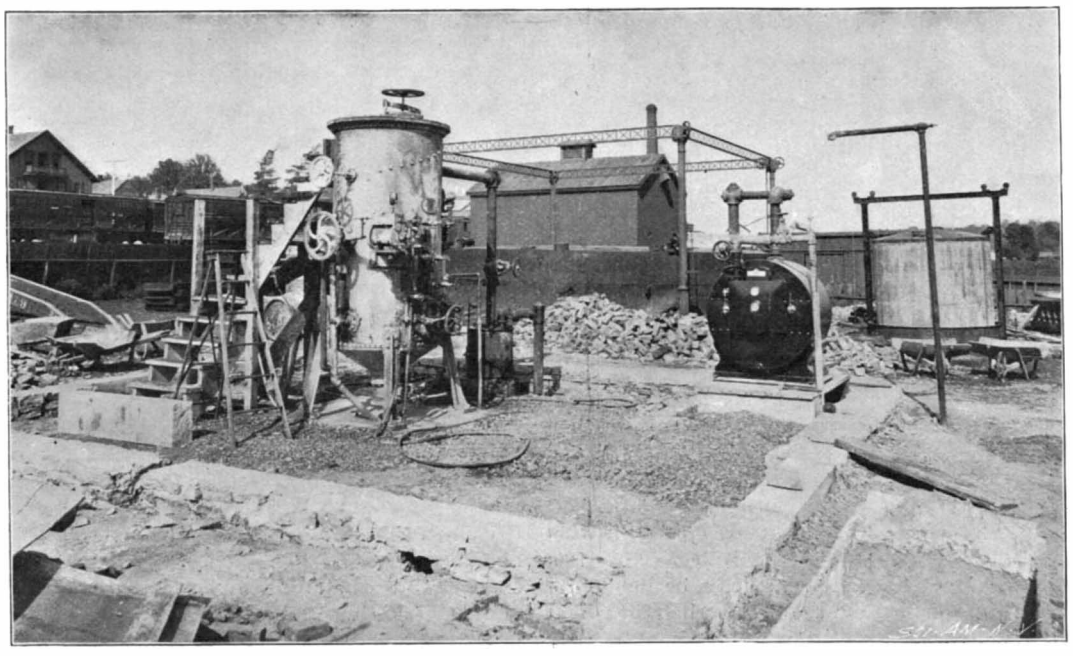
This plant was brought to public notice by an unfortunate accident in the afternoon of August 7, which was described in the SCIENTIFC AMERICAN, of August 19, page 119. The newspaper reports of this explosion were grossly exaggerated for little damage was done, as was evidenced by the fact that the city supply of gas was not interrupted and the generator and tank were uninjured. A leak occurred in one of the gaskets and the gas accumulated in the small brick building until there was an explosive mixture which was ignited by a jet left burning in the room. This leak was probably started by an excessive pressure due to the use of finely granulated carbide. The carbide dust, which was being used temporarily, gives off gas in the presence of an excess of water with great rapidity on account of the isolation of its particles. From the above statement it is evident that the explosion was one of little consequence, and in no way due to any unusually dangerous characteristics of the gas itself. The condition of the building after the explosion shows the enormous explosive power of the gas.

A word about the expense of the gas to the consumers may be of interest. It is sold by meter, and the price per cubic foot is at the rate of one-half cent per 16-candle power hour with discounts in case of large consumers and payment of bills in a specified time. This is cheaper than electric light, and the constantly increasing number of consumers indicates that it is a popular light both on account of its excellence and from the standpoint of expense.

What One Hears in the Telephone.

"It is very hard to realize that the voice one hears over the telephone is not the voice of the person who is talking," said an electrician, chatting about the oddities of the business, to a reporter of The New Orleans Times-Democrat. "It seems exactly like the real tones, drawn out thin and small and carried from a long distance by some mechanical means, but it is not. When one speaks into the instrument, a little diaphragm, like a drum-head, begins to vibrate, and each vibration sends a wave of electricity over the wire. These waves set up a mimic vibration in another diaphragm at the opposite end, which jars the air and produces an imitation of the original voice. That's not a very scientific explanation, but it's accurate. The autograph-telegraph, which makes a fac-simile of handwriting, is a fair parallel. You write your message with a pen, attached to a special electric apparatus, and a little ink siphon at the other end of the line exactly imitates every dot and curve. The result seems like the real thing, but is merely a first-class counterfeit. It's the same way exactly with the voice in the 'phone."

THE executors of the late Prof. O. C. Marsh of Yale University, have sold his valuable collection of orchids. The prices brought were extremely low. It was very unfortunate that a collection of this size and importance could not have been left intact.



THE PLANT AFTER THE EXPLOSION.

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Science Notes.

The new observatory and great refractor of the Astro-Physical Observatory, at Potsdam, were inaugurated August 26 in the presence of the German Emperor.

The highest observatory in Germany is now completed. It is situated on the Schnee Koppe, the highest summit of the Silesian Mountains, at an elevation of 5,216 feet. It will be managed as a Prussian State Institute.

Prof. Dewar found by using a rhodium-platinum resistance thermometer and by the use of methods designed to overcome the difficulties arising from the presence of air in the hydrogen, that the boiling point was —246° C. A constant volume hydrogen thermometer working under diminished pressure gave —252° C. The pure platinum resistance thermometer gave —238° C.

In France, at a small place near Quimper, a statue of a local hero was ordered of a sculptor and in due time the work arrived. One of the authorities of the town was not acquainted with bronze sculpture and was greatly disappointed when he saw the dull color of it, which was obtained with infinite care and labor by an expert colorer of bronze. The official ordered that the surface should be rubbed with emery paper until it acquired the appearance which was considered necessary. It is not likely that the official will ever become a Minister of Fine Arts in France.

For several years attempts have been made at Omaha and Los Angeles to hatch the eggs of the ostrich artificially, but so far we believe their attempts have been unsuccessful, the difficulty being the application of moisture. Now, however, an ostrich farm in Florida can boast of the first incubator-hatched ostrich in the United States. The incubation required forty-one days of careful watching, the thermometer was kept at 110° and the moisture was applied at intervals. A London concern manufactures many incubators for use in Cape Colony. The incubators are large enough to hatch seventeen eggs at one time.

Probably the largest poster ever used in the world was brought out by the committee in charge of the advertising of the Street Carnival at Battle Creek. The poster was neatly pasted on the pavement between the car tracks of the main thoroughfare. According to The Inland Printer this huge poster was printed in a roll of paper containing 2,264,000 square inches, each one 35 inches wide and over a mile in length. The printed matter was repeated every 24 inches. The poster was obtainable by diverting the printed web from its regular course to the folder end of the printing press and attaching it to a rewinding device.

A lady of Cincinnati was poisoned by the ink which is used on typewriter ribbons. Her fingers were stained by the blue ink used on the typewriter ribbon, and in trying to break a small blister on her lip she placed the stained finger on it, and very soon she felt a slight pain in her face. This was followed in a short time by a slight swelling. The pain then became almost unendurable and her lip began to swell badly and turn black. Everything that medical skill could do was done, but she got rapidly worse and died in great agony. The poisoned lip had swollen to gigantic proportions and nothing could reduce it.

It is not often that specimens in museums are destroyed by reason of being eaten, but it seems that in one of the Southern States a negro clayeater who was employed as a scrubwoman devoured some of the finest specimens of kaolin on exhibition at the State Geological Museum. The State geologist found that five blocks of clay which were very highly valued on account of their purity were missing, and upon examining some of the other specimens he found on them the impression of teeth. Detectives were set to work on the case and the negress employed to scrub the marble floors was accused of taking the specimens. The woman appears to have a mania for eating clay and she had been indulging her strange appetite for some time.

In a recent article in The Journal of the American Chemical Society, Mr. C. G. Hopkins, describes a method by which a jet of recently generated hydrogen can be ignited with absolute safety and without loss of time. As soon as the action begins collect the escaping gas in a test tube and when the latter is thought to be full of pure gas, remove it 2 or 3 feet from the generator and ignite the hydrogen in it; then immediately attempt to light the jet of hydrogen with a hydrogen flame contained in the test tube. If the gas is explosive, it will explode in the test-tube and leave no flame. If, on the other hand, a flame remains in the test-tube with which the jet can be ignited, it is certain that the gas in the generator is no longer explosive. By adopting the precaution, therefore, of never lighting the hydrogen jet except with the hydrogen flame obtained as described above, absolute safety can be insured. Attempts may be made to ignite the jet by this method as often as thought proper, and if the hydrogen is properly generated, the gas will be ignited in less than a minute.

Engineering Notes.

The average daily advance of the Simplon Tunnel is about 30 feet, but the contractors will have to average 42 to 46 feet per day in order to meet their engagements. About 2,600 men are at work with twelve drills. The calculated length between the two heads of the tunnel is 12½ miles.

A Western railroad company has adopted the method of making up its passenger trains with the sleepers next to the engine; the coaches come next and the baggage cars last. This reverses the usual practice. It is claimed that this arrangement makes the sleepers ride steadier, and there is also less dust.

The use of steel ties for experimental purposes on the New York Central Railroad has not given satisfactory results, says The Engineer. They are durable, but hard to line; the ballast shakes away from them and they give a rattling sound from the stone ballast and from the bolts, and this sound is disagreeable to passengers. Some have proved to be so unsatisfactory that they are now being removed and are being replaced by oak ties.

According to Commercial Intelligence, an American furniture manufacturing company is now shipping from its factories American furniture in the rough. Being in parts and tightly packed, it occupies little space and consequently the freight is low. It is put together in London and Glasgow workshops, and the salesmen place the furniture in the hands of dealers in England and Scotland. It is an excellent example of the enterprise with which our merchants are pushing our export trade.

The city of New Bedford, Mass., some twenty-five years ago, adopted and laid down a considerable quantity of iron pipe having a cement lining. The last of this pipe has just been removed, and it was found to be still capable of doing its duty, although the iron was considerably corroded at places. Some spots were corroded entirely through, although the cement held its shape. This is an excellent showing and proved the wisdom of the original commissioners who placed underground so large a quantity of this pipe. At the time it was laid, gas iron pipe was very expensive while cement-lined wrought iron pipe was comparatively cheap.

As we noted some time since, the Saxon State Railway ordered twenty locomotives from the Baldwin Locomotive Works. The order has caused such indignation in Germany that a semi-official note has been issued by the authorities, saying it would be impossible as a regular thing to order locomotives from a foreign firm, as the German engines are of a special type not used elsewhere and for the building of which German workshops have been specially fitted up, but the Saxon State Railway is an exception, light engines being used on this system. The order, coming as it does from Germany, must have been most gratifying to the Philadelphia firm and aggravating in the same degree to German builders, who could not compete in price or in time of delivery.

The Dismal Swamp Canal, which was originally surveyed by George Washington, was formaly opened for navigation on October 14. For more than a hundred years the waterway was abandoned. A procession of vessels passed through, the United States torpedo boat "Talbot" bringing up the rear. The canal cost nearly $1,000,000, and we have already illustrated its construction. It allows small vessels to go south through the inland route, avoiding the dangers which always exist in rounding Cape Hatteras. This route avoids the noted Diamond Shoals. The canal extends from Deep Creek near Norfolk to Pasquotank River, North Carolina, and is 22 miles long, 10 feet deep, and 80 feet wide. There are two locks, one at each end. The government will send all its light draught vessels through the canal.

Our naval exhibit at Paris will undoubtedly prove most interesting, and the models of the vessels which destroyed the Spanish fleets at Manila and Santiago will probably be as popular as any exhibit in the whole exposition. Models have not been made of all the ships, but of types of war vessels. They are now on exhibition in Washington in the State, War and Navy Building. The models were constructed at the Washington Navy Yard, and are exact reproductions of the vessels, to the smallest detail. A model of the "Maine" will probably be the most interesting to the average visitor. The model was built prior to the destruction of the battleship in Havana harbor. A working model of a dry dock will also be shown. It is an exact reproduction of the timber dry docks which are to be built at the Portsmouth, Philadelphia and Mare Island yards. According to The Marine Review, a model of the "Illinois" class will be exhibited in the dry dock. It can be docked and undocked just as the actual ship would be. Facilities are to be provided showing how the ship can be floated, and a complete system of piping and valves is provided so that the dock can be filled or drained. A model of a traveling crane is also provided.

Automobile News.

The number of automobile delivery wagons which are seen every day in New York is constantly on the increase. Drygoods firms are among the considerable users of these vehicles.

On September 20, the second race organized under the patronage of the Committee of the Berlin Exhibition was successfully run from Berlin to Leipsic, a distance of 115 miles. The average speed of the winning carriage was about 22 miles an hour.

A Belgian royal decree has approved the resolution of the provincial council of Brabant fixing an annual tax after January 1, 1900, on all automobiles. The tax will be $3·86 for an automobile weighing less than 880 pounds and vehicles which weigh more will pay $9·65 per annum.

It has been decided to make a trial of the collection of letters in Paris by motor wagons. The trial will last one month and if the experiment proves successful it will probably be generally adopted throughout Paris, and undoubtedly the hour of collection can be much delayed owing to the speed with which it can be effected.

It is said that the Committee of the Fairmount Park Commission which was appointed to examine into a report upon the advisability of admitting automobiles to the park drives will recommend that certain of these drives be open to the automobiles as an experiment, other drives to be opened if the results are found to be satisfactory.

The Italian army is now studying the advisability of introducing the automobile. It is considered that it could be used both for transporting ammunition from the rear to the firing line and for carrying the wounded to the nearest hospital. With comparatively free roads a higher velocity can be maintained with a motor carriage than with a horse. The roads in Italy are so perfect that experiments in this line should be very interesting.

A new factory for the manufacture of automobiles will be started at Buffalo, the New York Central Railroad being about to establish a system of automobiles for that city, and it is their desire to get the system into operation before the Pan-American Exposition. They realize the value of the horseless carriage as an advertisement in connection with the rates which the company will offer for the fair of 1901. C. E. Woods, General Manager of the Woods Motor Vehicle Company, of Chicago, is arranging the matter. It is thought that the automobiles will compete with the street cars.

Fifty years ago a steam carriage might have been seen on the streets of New York. It was the invention of Robert Dudgeon who is well known by reason of his many inventions. He used this carriage to go from his business to his residence in Harlem. Two bushels of coal were used on every trip, so it will be seen it was not a particularly economical means of conveyance. The water tanks carried 60 gallons. Finally after being used for about ten years the city authorities forbade its use on the streets of the city and it was taken on Long Island where it ran for some time on country roads.

All the horses in the royal stable of Her Majesty Queen Victoria have been drilled in the presence of an automobile. The horses in the three stableyards at Windsor Castle were first led and then driven around the stationary car, then the car was propelled around the horses and finally the horseless carriage was moved between the horses as they stood near each other. The horses behaved very well as they had already been schooled to such noises as the playing of bands, the sound of cannon, railway trains and the cheering of crowds. Strange to say the best bred horses cared the least about the automobiles and according to The New York Sun a pure bred Arab stallion showed the least concern of all. Few lives are watched with such care as the Queen's and those of the members of the royal family, hence the trouble which has been taken to protect Her Majesty from any danger while driving, through the meeting of automobiles.

The Automobile Club of America had a formal meeting on Monday, October 16, and a constitution and by-laws were adopted and permanent officers were announced. The Club promises to be a large and influential body and it was suggested at a meeting held in June when temporary officers and an executive committee were appointed. It is probable that the choice of a permanent club house will soon be made and that arrangements will soon be perfected for the storage of vehicles, depots for charging and repair shops with skilled help. The club will appoint legislative committees who will use their efforts to prevent the passage of unjust laws and to attempt to get laws passed in the interest of automobilists. The Automobile Club of Great Britain now has 500 members, and the Association has procured the passage of considerable necessary legislation. The President of the Automobile Club of America is General Avery D. Andrews, Secretary, Homer W. Hedge.

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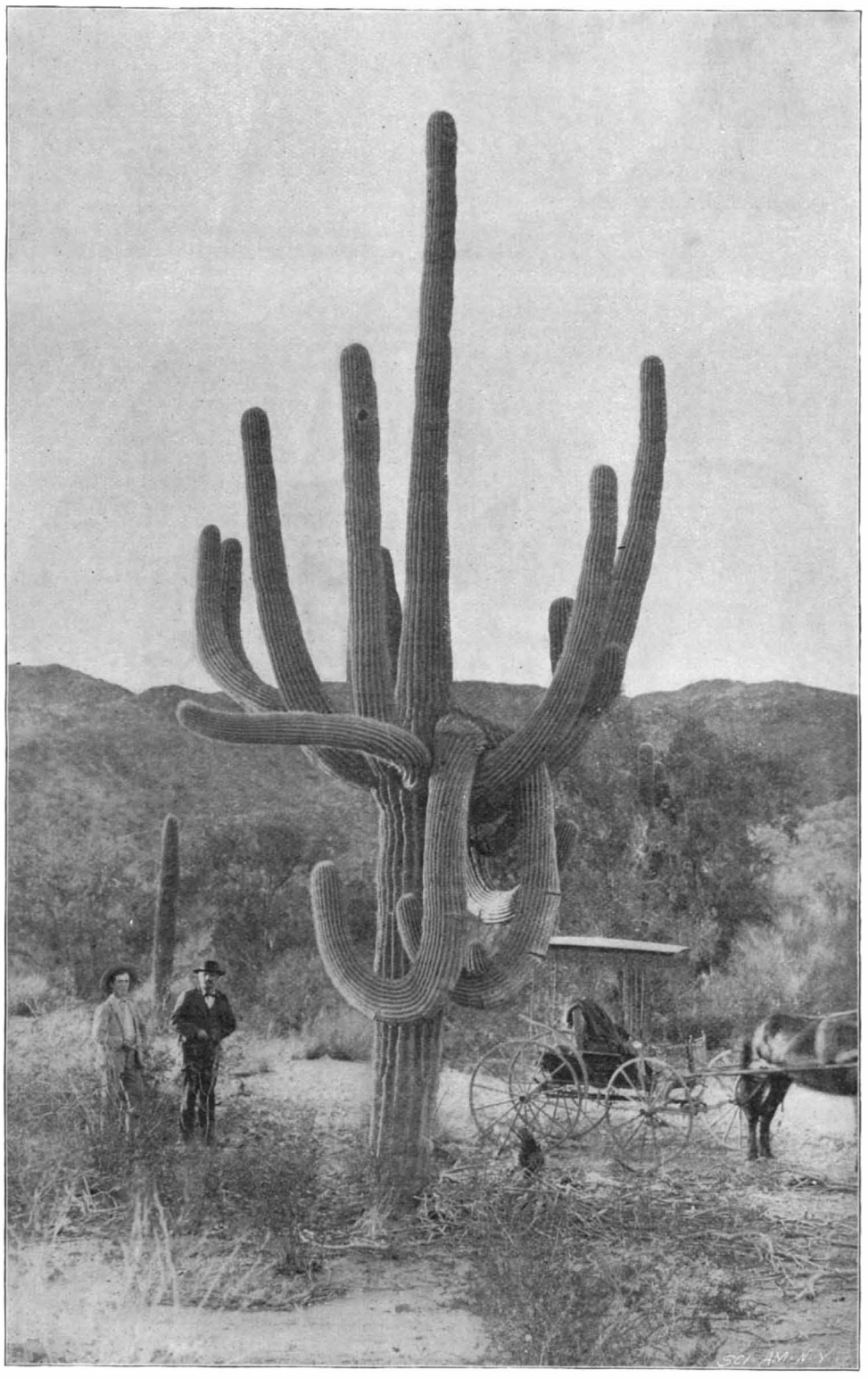
A GIANT CACTUS.

Cactus is a genus of plants, the type of the natural order cactaceæ and comprises numerous species, all of which are native to America. The name was originally given by Theophrastus to a spiny plant found in Sicily. The stems of the cactus are usually leafless and fleshy, globular or columnar, and are armed with spines and bristles. The structure of many of the species is singular and groteque in the extreme, and the roughness of the stalks and the beauty of the flowers make them one of the most interesting botanical curiosities of our continent. They are found chiefly in the hot stony places of tropical America, and their tough and almost impenetrable skin encloses abundant juice which enables them to support a sluggish, vital action without inconvenience even in a parched soil. Some of the varieties of cactus are only a few inches high, while others attain a height of forty feet. It is a curious fact that the cactus flourishes even at the foot of Mt. Etna in Sicily. The most splendid example of the cactus family is the giant cactus of which we show a fine example. Our photograph, was taken by Mr. A. F. Messinger, the well-known view photographer of Phoenix, Arizona. The cactus is still standing although it is slowly rotting and will soon fall. Mr. Messinger found it at a point about 8 miles south of Phoenix, near the Pima Reservation. It is about 40 feet high and is of the form shown in the engraving. What the date palm is to the African deserts, the giant cactus is to our own arid lands. From it the Mexicans extract the drink called "mescal," and the Indians also obtain a beverage from it. On its fruit the Papago Indians live for weeks at a time. Woodpeckers dig their nests in the trunks and branches, and even doves feed on the fruit. When the cactus of this kind dies its usefulness is not destroyed for the tough ribs beneath the outer skin are used by the Papago Indians for the foundation for their mud roofs, and also use it in building chicken coops, and even as a covering for their graves. This is not the species of cactus from which travelers are supposed to obtain a supply of water, but it is the small cactus which contains a plentiful supply of sap.



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A GIANT CACTUS NEAR PHOENIX, ARIZONA.

Tapestry Weaving in America.

There is a transplanted industry in the village of Williamsbridge on the Bronx, now a part of New York, for here a little colony of French tapestry weavers have been working on hand looms for the last seven years. It is believed that it is the only colony of its kind in America. There are now twenty-two looms and sixty workmen and workwomen who are engaged in making beautiful tapestries for curtains, portières, borders, chair coverings, etc. Williamsbridge was selected in order that the workmen would feel at home. The ateliers are on the Bronx River, and in the waters of this stream was discovered the same properties that made the waters of La Bièvre so invaluable to the Gobelin dyers. This was owing to the dissolved vegetable substances which the waters then contained, as does the Bronx River now. For a long time, however, the Gobelin works have ceased to employ the Bièvre water which gradually became too impure and they have tried to supply by chemicals the qualities which this water once possessed.

The looms before which the workmen set are of different size according to the piece being wrought. On some are made portières which measure 24 feet in length, and other wall panels 30 or 40 feet long; others are built for small pieces like the back and seats of chairs. According to The Evening Post, from which we glean our particulars, the skeleton threads over which the design is worked are either of linen or of wool. The fabric is worked on a chain of threads which are drawn either vertically or horizontally and around which are woven the colored threads of silk or wool, making one body. The colored cartoon is laid beneath the fretwork of the threads. The laying in of the colored threads is done entirely by hand and the weaver follows line by line the painting beneath. The right side of the fabric is placed toward the painting underneath, the reverse side being always uppermost. The vertical threads of the warp are divided by the fingers which keep one-half of them in advance of the rest, but those behind can be brought forward whenever required by means of small cords, one of which is attached to each warp thread. The left hand is introduced between the two sets of threads, taking up as many as need be, and through these the "flute" containing the thread is passed from left to right. The thread when stretched is plied with a round flute and is then pressed back in the contrary direction through the space opened. By ingeniously combining the woofs the colors are made to blend perfectly and the effects produced are like those of paintings.

Where the color breaks off suddenly and a new one is introduced right at its side, a slit is left in the warp one side of which is the edge of the finished section and the other the prospective edge in course of construction. A large piece is as full of these slits as there are colors introduced in the design. After the piece has been taken off the loom it is sent to the sewing room below. The pieces are stretched on frames made to fit them, and each slit is stitched up and down as carpets are sewn with colors and shades matching each particular section, and afterward a stitch similar to the one taken by the weaver is made along the line until all trace of joining is concealed. This naturally requires great skill. The same needlewomen repair the priceless antiques which have been made at the Gobelins in Paris.

Birds Nesting on the Sea-Shore.

Many persons are under the impression that shore-nesting birds make no nest, but lay their eggs indiscriminately among the shingle. This Mr. Patten, in the September number of The Irish Naturalist, shows to be a complete misconception so far as the Little Tern is concerned. As a matter of fact, the bird excavates a conical pit in the sand about two inches deep. Immediately round the "crater" a narrow zone of sand is cleared from shingle; and when completed and containing its full clutch of two or three eggs, the deepest part of the nest is filled with broken shells into which the eggs are wedged with their points downward. As the eggs are disproportionately large in relation to the bird, it is manifest that the position in which they are placed renders them most easily covered by the brooding hen. It has been assumed that the "crater" is excavated by the hen-bird "breasting" the sand in the manner that sparrows dust themselves by the roadside, but the author is of opinion that the work is done with the beak.

The International Commercial Congress.

The International Commercial Congress opened at the Philadelphia National Export Exposition on October 13. Representatives of trade and commerce from all quarters of the world to the number of nearly four hundred assembled in the great Exposition building. Countries like Great Britain and Germany sent their best qualified men and Japan was represented by a score of duly qualified envoys. Many of the delegates were appointed directly by their home governments, and some of the countries showed their sympathy with the objects of the Congress by the presence of their diplomatic representatives. The ceremonies incident to the formal inauguration were simple, but impressive. They consisted of a welcome from the National government by the first Secretary of State, Dr. David Hill, one on behalf of the city by Mayor Ashbridge and other addresses were made by the Hon. George F. Edmunds, the Director-General of the Exposition, and Dr. W. P. Wilson. The addresses were interspersed by music by the band of the United States Marine Corps detailed for this duty by the Government. A reception by the Mayor to the delegates and visitors to the City Hall concluded the ceremonies of the day. On the succeeding day the business sessions began in the Convention Hall on the second floor of the northern pavilion of the Exposition building. The Ex-Speaker of the House of Representatives, Hon. Thomas B. Reed, was made Chairman. Many addresses were made which proved to be most interesting. The value of the Congress to our commerce will undoubtedly be very great.

The Current Supplement.

The current SUPPLEMENT, No. 1243, has a number of valuable lectures and papers. "The War in the Transvaal" gives a map of the territory and some interesting views of President Kruger and his country. "The History of Hybridization" is by Dr. Maxwell Masters. Dr. R. H. Thurston's "Evolution of Technical Education on Economics, Politics and Statecraft" is continued in this number. "The Comstock Lode" is an article by L. P. Gratacap. "Displacement of Fluids by Moving Bodies," by M. F. Mithoff, is an interesting and important study and the second installment is published in this issue. Dr. Horace T. Brown's "Fixation of Carbon by Plants" is continued, as is also Sir Michael Foster's "The Progress of Science and Its Results."

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

PLOW.—WILLIAM M. TILLER, Point Peter, Ga. The plow consists of a standard composed of a bar bent upon itself at its middle to form opposite arms separated to produce a slot. A cross-bar is provided, bent at its central portion to conform with the standard and with an opening for the bolt, which secures a longitudinally-slotted bar to the standard. Drag-bars, provided with shovels, have at their front ends shoulders bearing in front of the cross-bar, and near these ends bolt-holes register with the longitudinal slot of the cross-bar. Bolts secure the drag-bar to the cross-bar; and the cross-bar is in turn bolted to the standard.

Electrical Apparatus.

ELECTRIC METER.—PAUL EIBIG, Annenstr. 16, Berlin, Germany. This electric registering apparatus comprises a double-working mechanism with balance-lever adjustment in which the stationary current-feed coils act upon two pairs of tension-coils mounted on balance or double armed levers, and oscillating constantly under the influence of two clockworks, as in the case of horizontal pendulums, with a small amplitude, the action of the current-feed coils being such as either to attract or to repel the two pairs of tension coils. The difference thus obtained in the operation of the two clockworks serves as a means for measuring the amount of electricity used.

VOLT AND AMPERE METER.—JAMES D. ROSS, Victoria, British Columbia, Canada. The present invention provides a novel volt and ampere meter which is not affected by heat or atmospheric changes. The instrument comprises two air-tight cylinders or casings equal in capacity, with means for regulating the initial pressure in the casings. A resistance arranged in one of the cylinders or casings is adapted for connection with an electric conductor. The variations in pressure caused by the passing of a current through the resistance in one of the cylinders or casings controls an indicator.

BINDING-POST.—WILLIAM ROCHE, Jersey City, N. J. The post comprises a core screw-threaded exteriorly and slitted longitudinally from the end inward. The screw-thread extends inwardly beyond the inner end of the slot. A clamp or nut is constructed to screw on the core and has a funnel-shaped interior enlargement at one end of its bore. The slotted core is of service when it is desired to connect a wire with another which is already fastened at both ends, without detaching the fastened wire at either end. A clamping-nut works on the screw-threaded core and holds the wire against twisting or slipping, with no danger of breaking it.

Engineering-Improvements.

ROTARY ENGINE.—WILLIAM F. JAMES, Quintana, Tex. The engine has a casing acting as the cylinder or steam-space, and a disk mounted on a shaft and rotating within the cylinder. The disk has a projecting piston filling the steam space, and the casing has a hinging abutment which drops down behind the piston and closes the steam space of the cylinder. A lug at the upper end of the abutment seats upon the casing and limits the inward swing of the abutment. The abutment and casing have a registering plunger and a receiving-recess, forming a dash-pot to check the seating action.

Mechanical Devices.

LOCKING OR UNLOCKING MEANS FOR EMERGENCY EXIT-DOORS.—THOMAS E. HEWITT, 115 Newington Causeway, London, S. E., England. The invention provides a means for securing and releasing the emergency exit doors of public buildings, and has for its object to enable the door to be bolted both at the top and bottom, and yet to be instantly and automatically unfastened in case of emergency or panic, not only without the application of pressure against the door or its fastenings, but even without the exercise of volition on the part of the persons seeking to escape.

FILLING-BOX FOR COTTON PRESSES.—OLE A. THORSEN and JOHN E. SHUTT, Ganado, Tex. The filling-chamber for forming the bales before their insertion into the press, has its sides and ends separable. The sides are mounted on arms at one end. Pivots are provided at the outer ends of the arms; and links connect the arms near their pivots with the adjacent end section of the chamber, whereby the end section is moved outwardly by the swinging outward of the sides. By providing ball-bearings the sides are swung with little exertion. The boxes are firmly supported without using rollers or tracks.

WASHING-MACHINE.—JOHN W. FISHER, New Philadelphia, Ohio. The machine belongs to that class in which a reservoir provided with a corrugated surface, contains a rubber which swings over the bottom to wash the clothes. On the body portion of the washing-machine a cover is mounted with which links are pivotally connected. A rubber is pivotally connected with the cover; and a number of the links are slotted to permit the rubber to be swung on a pivot or to be moved up and down.

BOX-SEALING MACHINE.—JOSEPH T. CRAW, Jersey City, N. J. The object of this invention is to seal the flaps of paper boxes so that the sugar or other granulated material contained in the boxes can not escape. The machine applies a sealing compound such as glue or gum to the top and bottom surfaces of a sealing strip or to a series of connected strips capable of ready separation. A casing is likewise provided, whereby one or more empty or filled boxes may be received and held and the sealing-strips simultaneously applied to all the boxes at one end, so that all the boxes in the casing at one end may be simultaneously sealed. The individual devices may be used either separately or collectively.

SELF-WEIGHING SCALE.—ALVA W. B. JOHNSON, Mount Vernon, Ill. The scale is provided with a scoop and with an elevator for removing the surplus material from the scoop. A motor drives the elevator, and a solenoid controls the connection between the elevator and motor. A clutch is provided comprising a spring-pressed member controlled by the solenoid and rotated by the motor. The other member of the clutch is adapted to be engaged by the spring-pressed member and is geared with the elevator. As soon as the current is shut off in the solenoid, the clutch disconnects the elevator and motor, so that the momentum of the motor will not affect the elevator. The elevator will thus come to a standstill. The load in the scoop is, consequently, not reduced beyond the true load.

MACHINE FOR GRANULATING TOBACCO.—ARCHIBALD PICKEN, Roanoke, Va. This machine has a reciprocating cutter-head comprising a frame or carrier to which blades or cutters are secured, having their cutting edges stepped. Each step projects in advance of the preceding. A transverse cutter is likewise secured to the head. By the stepped construction, the tobacco is cut with three successive cuts, and is not disarranged as in other machines in which the whole cut is made at once by a single blade. As the cutter-head descends, the transverse cutter cuts off the portions of tobacco previously slitted by the upright cutter, thus securing the granulation desired.

Railway-Appliances.

CAR.—JAMES F. DUNN, Salt Lake City, Utah. The invention provides a construction involving a timber-cap for protecting the ends of the draft-timbers in railway cars, by which means to prevent the timbers from being chafed and split, to which action they are especially liable during the use of the car. The invention also involves a peculiar arrangement of these caps with respect to the draft-timbers and sills of the car, so that an exceedingly durable and effective structure is attained.

FROG.—ABRAM VAN BRUNT, Brooklyn, New York city. Ordinarily when the points of frogs are broken, the whole frog must be removed and a new one inserted, which operation involves much expense and inconvenience. The present invention is designed to prolong the life of the frogs indefinitely and embodies features of construction by which the points of the frogs and crossings are rendered removable from the main portions so that new points may be substituted for old ones.

DUST-GUARD FOR CAR-WINDOWS.—HUGH B. SHUTTS, Shawneetown, Ill. Dust-guards for car-windows are usually made detachable and are not in position except when put in use. The present device is intended to be attached to the car-window at all times so that a passenger may operate it whenever desired. The guard is mounted at one side of a window-frame and sash to swing inward and outward. At one side of the frame and adjacent to the guard a lever is fulcrumed connected by a link with the guard. The device is folded inward by the engagement of the sash with the lever.

AXLE LUBRICATOR, WIPER, AND DUST-GUARD.—JAMES S. PATTEN, Equitable Building, Baltimore, Md. The means for applying the lubricator comprise rollers held in a frame pivoted transversely and centrally on a spring so as to allow due "play" of the rollers corresponding with the positions of the axle-journal. The means for wiping the journal and preventing the waste and escape of the lubricant include side-bars or wipers arranged laterally over the rollers and supported by springs, and spring-supported combined dust-guards and oil-baffles conforming with the required position for best performance of their function. The entire apparatus is the result of long observation and practical experience with devices for lubricating car and locomotive axles.

PEDESTAL BRACE-BOLT.—JAMES F. DUNN, Salt Lake City, Utah. The present invention provides an effective means for bracing the pedestal, which means may be readily removed in a downward direction without interfering with the spring-rigging of the locomotive. The pedestal jaws have slots formed in their lower ends and opening downward and terminating at their outer ends in recesses. A bolt extends through the slots. At each end of the bolt are means for drawing the bolt into operative position, these means also serving to enter the recesses in the pedestal-jaws to prevent the dropping of the bolt through the slots.

Miscellaneous Inventions.

PIPE-COUPLING.—ARTHUR B. HENRY, Ormsby, and TIMOTHY F. MULLIN, Bradford, Pa. This pipe-coupling for gases and liquids has internally-threaded end sections and an intermediate smooth section. Annular grooves at the inner ends of the threaded sections receive packing-rings. Pipes screw into the threaded end sections of the sleeve and have their ends reduced to form annular flanges for fitting into the packing-rings. Shoulders abut against and press the outer side edges of the packing-rings. The coupling prevents leakage on expansion and contraction of the pipe and avoids injury to the packing by the crosswise action of the fluid passing through the coupling.

DRAINING ATTACHMENT FOR VESSELS.—LUCIUS A. DOBLE, Huron, S. D. The attachment is designed to hold the cover on a kettle so as to permit the water in which the food has been cooked to be drained off. The attachment comprises clamping members for engaging over the upper edge of a vessel, with which clamping members, brace members are connected, terminating in a handle. The clamping and brace members have interlocking loops adapted to be engaged by the bail of the vessel. A locking member is extended from the clamping member. The device can be adjusted to various sizes of vessels.

WICK RAISING OR LOWERING ATTACHMENT FOR BURNERS.—ROBERT W. MCFARLAND, Paulton, Pa. The invention provides a wick raising and lowering device especially adapted for use upon lanterns and capable of being operated from the bottom of the lantern. The attachment comprises a wick-spindle provided with a pinion which is received by a section of a hanger mounted to swing upon the burner and provided with a locking device. One end of a shaft is mounted in the hanger, the other end being loosely mounted in the base of the lantern. A gear is carried by the shaft, adapted to engage the pinion of the wick-spindle to raise and lower the wick.

CHEESE-CURD AERATOR.—CHARLES J. MOORE, Deer Creek, Minn. In warm weather it is a matter of considerable difficulty to cool cheese-curd to the proper temperature for pressing. It is the purpose of this invention to provide an apparatus whereby the curd may be rapidly cooled and all poisonous gases removed. The apparatus in question is an aerator comprising a rotating cylinder with a hopper at one end for the passage of the material. A tubular shaft at one end of the cylinder is extended through the hopper and connected by a spider with the cylinder. Fingers on the shaft press the material through openings in the bottom of the hopper. A fan-shaft carrying a fan provides the necessary blast for the cooling of the curd and removal of impurities.

SACK-HOLDER.—ELI MONDEN, Rawlins, Wyo. The holder is designed to support sacks when receiving ore, grain, or any other material, and is composed of a frame open at one side, on which frame sack-supporting bars are mounted to swing both laterally and vertically. A hopper has swinging connection with one of the bars and acts to guide the material into the sack.

EYEGLASS GUARD OR CLIP.—ROBERT KABUS, Garretson's, Richmond, New York city. The guard or clip comprises a bracket-arm to which a sleeve is pivoted so that it can be laterally adjusted thereon. In the sleeve a body-plate is longitudinally adjustable. The glasses to which the attachment is applied can be adjusted by the wearer to move the lenses up or down in a vertical plane or laterally to or from the eyes, so the guards or clips can be quickly adapted to any shape of nose.

COMBINATION-TOOL.—BENIAMINO IBELLI, Brooklyn, New York city. This combination-tool is used mainly for mechanical purposes and includes a two-part foldable rule, the members of which are recessed to receive a jointed knife-blade; an extensible, graduated measure that will form a square when partially folded; a weighing device having a compressible spring to indicate degrees of weight on an extension-bar; a foldable hook on the bar; and a manicure-tool.

METHOD OF REFINING CUPRIC-SULFATE SOLUTIONS.—OTTOKAR HOFFMAN, Argentine, Kan. By this new method, the crude cupric sulfate solution is refined, thereby dispensing with the usual refining of the material. Any copper matte or sulfureted copper ore, rich or poor in copper, after roasting furnishes a suitable material. The method employed consists in first neutralizing the solution, then heating it, adding cupric oxid, and finally injecting air into the solution to precipitate the impurities. The crystals obtained are purer and more permanent than those usually found in the market, because they contain no free acid.

RECKONER.—CHARLES TREGONING, Manhattan, New York city. By means of this device, various amounts may be added or subtracted and the sum total or difference obtained. The device is so constructed that any one of a number of multiplication-tables may be instantly brought to view. The reckoner also contains one hundred or more addition-tables and one hundred or more subtracting-tables, and is particularly adapted to assist children in mastering the rudiments of arithmetic.

ATTACHMENT FOR WATCH-LATHES.—CHARLES M. WILLIS, Browns, Ill. The present invention provides an attachment for watch-lathes by which various elements of clocks and watches may be effectively held by the lathe, the attachment taking the place of the usual face-plate of the lathe. The attachment includes a disk provided with equidistant openings near its periphery. Between the openings are radial slots. Clamping-fingers are adapted to be secured to the disk by having their fastening devices passed either through the opening or through the slots, whereby provision is made for securing a piece of work or a work-holder to the disk.

FLOUR SIFTER AND MIXER.—ANNIE D. SMITH, West Orange, N. J. The invention provides a new and improved flour sifter and mixer, which besides being of durable construction, is arranged to permit a ready opening up of the flour and a thorough and uniform incorporation of the baking-powder with the flour. All lumps are broken up and the mixture is gradually forced through the meshes of the sieve in a finely-divided state.

NUT-LOCK.—RICHARD H. THOMSON, Osceola Mills, Penn. The lock comprises a nut having a pocket communicating with the bore of the nut. One wall of the pocket extends eccentrically to the bore. A roller is mounted in the pocket. A spring is attached to the nut within the pocket and bears against the outer side of the roller to throw the roller inwardly toward the bolt. When the roller and the spring are removed from the pocket, the nut can be used in the same manner as nuts of ordinary construction.

MAIL-POUCH.—THOMAS H. STOKES, Lincoln, Ill. The mail-pouch has its back portion extended beyond the front at its mouth. A plate is bent over the edges of the extended portion of the back and is orificed to receive the staple. The rear sides of the plate has a card-socket at a point downward from the orfice and opening at the side thereof adjacent to the mouth. A staple is secured to the front of the pouch adjacent to the mouth, whereby the extended back of the pouch may be folded down in front of the pouch to engage the staple, thus serving to hold the bag closed and also to retain the card in the pocket.

DEVICE FOR HOLDING BLOTTERS.—JAMES M. RIX, Warner, N. H. The device can be attached to a desk and is provided with a stand. The device is so constructed that a blotter pliably connected therewith, can be readily and conveniently carried to any portion of the desk and automatically returned to the device when released. The blotter can be made to remain on the desk or table as long as required without disconnecting it from the device, and can be exposed at all times and quickly detached.

CARPENTER'S SQUARE.—ROBERT H. MILLER, Morristown, N. J. The square has two legs formed of separate pieces connected by a mortise and tenon. The tenon has a notch in one edge at its base, and the mortise has a groove in its edge in line with the notch. A locking-bar is mounted to slide in the groove and engage the notch in the tenon. A pivoted block occupies the groove beyond the locking bar, and when longitudinally extended fills the remainder of the groove. The legs can readily be separated and placed within a comparatively small box or chest.

STUMP-BURNER.—JOHANN A. O. BREDEMEYER, Seattle, Wash. The stump-burner is made in sections superimposed the one on the other, to form a tapering body serving to inclose the stump. A hood is mounted on the uppermost section of the body and is provided with a smoke-outlet pipe. Sliding doors command draft-orifices in the several sections of the body, and draft-conductors in communication with the orifices are situated within the body and extend downwardly from the openings to cause the draft to pass down into the body of the burner and toward the base of the stump.

Designs.

FOOTSTOOL.—FRANK L. UNDERWOOD, Vermont, Ill. The leading feature of the design consists of a top with a ridge flanked by horizontal portions. The footstool is chiefly ornamental.

PLATE OR SIMILAR ARTICLE.—EDWARD BOOTE, East Orange, N. J. The leading features of this design are to be found in a series of scroll-stems in circular order, festoons of foliage and floral sprays draped at the scroll-stems, and a circular panel in which are a chain of flowers, buds, and branches of wild-rose.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

INSECTS: THEIR STRUCTURE AND LIFE. A Primer of Entomology. By George H. Carpenter. London: J. M. Dent & Company. New York: The Macmillan Company. 1899. 16mo. Pp. 404. 183 illustrations. Price $1.75.

This is one of the best books on insects which we have seen. It is handsomely printed and the illustrations are most of them on a good scale. The diagrams are particularly helpful. It is a thoroughly scientific book on the subject and will be appreciated by all those who are interested in the subject.

FIRST APPENDIX. SIXTH EDITION OF DANA'S MINERALOGY. By Edward S. Dana. New York: John Wiley & Sons. 1899. 8vo. Pp. 75. Price $1.

This appendix contains full descriptions of the species announced as new since the publication of the "System." There are no fewer than 160 new names, and their place and general scheme of classification is shown in the list given in the Introduction. The arrangement is alphabetical, rendering an index unnecessary. It is not necessary to praise the splendid "System" of the two Danas, and it is the most authoritative work on the subject in the English language and possibly in any other language.

NORTH AMERICAN SLIME MOULDS. By Thomas H. McBride, A.M., Ph.D. New York: The Macmillan Company. 1899. 8vo. Pp. 231. 18 plates. Price $2.25.

This book is an admirable example of the esteem in which scientific works are now held in the United States. There was a time when a book of this kind would never have been accepted by any publisher, owing to the fact that the circulation would be so small. Now, however, the demand for scientific literature has increased so that the admirable book before us can be placed upon the market at a moderate price. The author has acquitted himself of a difficult task with great credit, and the publishers are to be congratulated upon the production of a handsome book.

A CYCLOPEDIC REVIEW OF CURRENT HISTORY. Second Quarter. 1899. Boston: Current History Company.

This publication occupies a unique field. It is really a short annual cyclopedia, dealing with important current events. The present issue, for example, takes up wireless telegraphy, the Peace Congress, the Samoan difficulty, the Dreyfus affair, etc. There is hardly any important event in the world's history not to be found chronicled here.

A TEXT BOOK OF PLANT DISEASES CAUSED BY CRYPTOGAMIC PARASITES. By George Massee, F.L.S. London: Duckworth & Company. New York: The Macmillan Company. 1899. 16mo. Pp. 457. Price $1.60.

The aim of this book is to enable those directly occupied in the cultivation of plants and with but a limited period of time available for study to determine the nature of diseases caused by parasites of vegetable origin, and to apply in the most approved manner those curative and preventative methods which experience has shown to be most successful in combating the particular form of disease under consideration and finally to include in the daily routine of work precautionary measures which, without being costly, frequently prevent a slight disease from assuming the proportions of an epidemic.

MODERN AMERICAN SCHOOL BUILDINGS. Being a Treatise upon and Designs for the Construction of School Buildings. By Warren R. Briggs, F.A.I.A. New York: John Wiley & Sons. 1899. 8vo. Pp. 411. Price $4.

The subject is treated with rare ability. Schoolhouses of all sizes and costs are dealt with and the work gives precisely the information which is always sought by principals and school boards. Many of the problems connected with the designing of schools are thought out, saving many costly and doubtful experiments. Special attention is given to heating, ventilation and sanitary arrangements. It is an admirable contribution to American architectural literature. We regret to note, however, a serious omission, there is no index.

DISCOURSES ON METHODS. By René Descartes. Chicago: The Open Court Publishing Company. 1899. 16mo. Pp. 87. Price 25 cents.

Descartes' classical work has been translated in French and collated with the Latin by John Veitch, LL.D., and is an admirable edition for those who wish to know something concerning a work by a great philosopher and mathematician.

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Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(7738) A. M. D. asks: 1. In the electrolysis of water about what per cent of the energy of the current is lost in producing heat in the solution? A. The heat developed in any circuit by the passage of an electric current through that circuit is expressed by Joule's law

$$\text{Heat} = 0{\cdot}24\ C^2Rt.$$

in which C is the number of amperes, R is the number of ohms, and t is the time in seconds. The heat is found in calories. This equation is derived from the fact proved by experiment that one ampere flowing through a conductor having a resistance of one ohm will develop in that conductor 0·24 calories for each second it flows. It makes no difference whether the current is decomposing water or doing any other work. The heat produced is the same. This is the lost energy of an electric current. 2. How does the heat developed by burning the oxygen and hydrogen combined, compare with the original energy of the current? A. The doctrine of the conservation of energy requires that the heat produced by recombining the oxygen and hydrogen into water shall exactly equal the energy in any other form which may be required to decompose the same quantity of water into its constituent oxygen and hydrogen again. This heat has no connection with the heat of the first query.

(7739) W. P. asks: I have a 4-ohm telegraph instrument. What number of wire (by A. W. G.) and how much must be used to wind it for 20 ohms? To change your 4 ohm sounder to make it have 20 ohms, you can unwind the wire on it at present and get 4 times as much of the same size to be put on together with that which was on the sounder before. If you know the number of the wire now on the sounder you can find from a wire table the length needed to make 16 ohms. This is the quantity you need to add to the sounder.

(7740) A. B. T. asks how the slit is cut in the nibs of a steel pen. A. The slit in steel pens is cut in a shear press with very sharp cutters.

(7741) A. B. S. asks: 1. Will a small hand-power dynamo, as described in "Experimental Science," furnish power enough for spark, to ignite gas in gas engine? A. The hand-power dynamo will give a spark which will ignite gas. It will probably serve your purpose if driven at a high speed. We have recently advertised a dynamo especially designed for this work. 2. What is a jump spark? A. A jump spark is a spark produced by the breaking of an electric circuit, and which jumps between two metallic points. 3. Is it necessary to have iron jar for caustic potash cell as described in "Experimental Science"? A. The iron jar is one of the electrodes in the potash cell. If you use a glass cell you will require an iron plate in the liquid as an electrode. Since an old iron pot will answer every purpose it is the cheapest method of putting up the battery.

(7742) S. C. asks: 1. How is electricity transmitted through the air as is thus done by the wireless telegraphy? A. The waves produced by an impulse of electricity through a wire, fly off from the wire in all directions. If the wires are properly arranged the waves may be perceived by a properly constructed apparatus at a long distance from their source. 2. How is the record of the gramophone made? A. The record of the gramophone is at first traced upon zinc, and afterwards etched into the zinc. This is transferred to hard rubber disks such as are used for the instrument. From the zinc disks a large number of impressions may be taken. 3. Of what are the diaphragms of talking machines made? A. The diaphragms of talking machines are made of thin glass, celluloid or iron.

(7743) H. W. C. writes: I have a small range boiler, galvanized iron, which I use for oxygen tank for lantern use. Now the tank is badly corroded inside and I wish to know what kind of paint or varnish would be suitable to use that the gas or any dampness carried over from wash bottle, would not affect. A. If your oxygen tank is badly corroded, you should not use it, since it is in danger of bursting under pressure. Asphalt varnish is the best substance to use to coat the inside of such a tank as a preventative of rust but we do not think it would be safe to use paint or varnish of any kind on the inner surface of the tank. The better way is to dry the oxygen before it enters the tank, since oxygen in presence of water will rust iron or steel very rapidly. If the gas were passed through calcium chloride after it leaves the wash bottle it would enter the tank dry.

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Grain header, J. C. Lynch ... 635,264
Grapple, Reimer & Olsen ... 635,146
Grass cutter, C. Kieser ... 634,946
Grate, R. Goll ... 634,886
Guard rail, W. Morrisey ... 635,144
Gun telescope attachment, Von Kretschmar & Vollmer ... 635,102
Hammock and elevator, J. C. Lassiter ... 635,261
Handkerchief holder, F. W. Bostrom ... 635,121
Hanger device for supporting boarding or planking on iron girders, A. Bremer ... 635,122
Harness loop bushing, J. N. Phillips ... 635,022
Harrow seeding attachment, disk, Rogers & Kennedy ... 634,997
Harrow tooth fastening, J. C. Tunnicliff ... 635,111
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Harvester, pea, W. G. St. John ... 635,064
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Hay carrier stop, W. Louden ... 634,948
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Heater. See Electric heater. Feed water heater. Tank heater.
Heating system, air, H. L. Goodwin ... 635,042
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Jar closer or opener, L. Look ... 635,049
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Knife. See Chopping knife.
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(Continued on page 286.)

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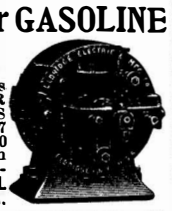

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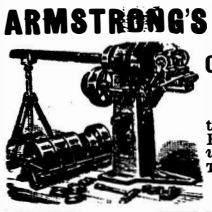

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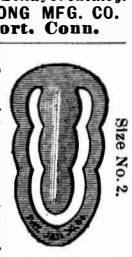

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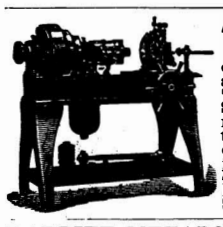

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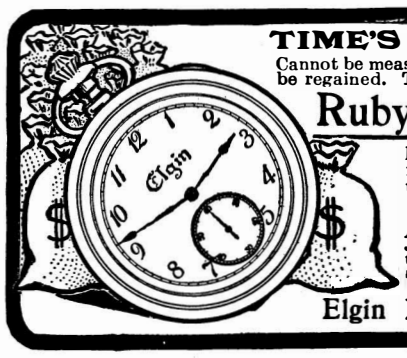

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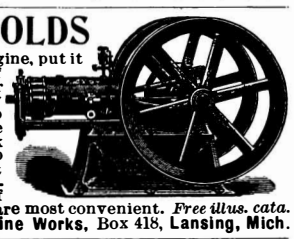

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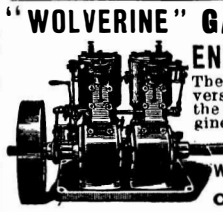

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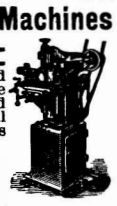

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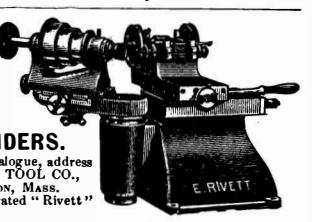

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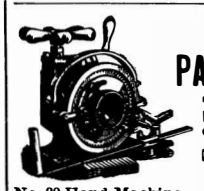

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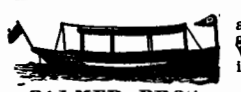

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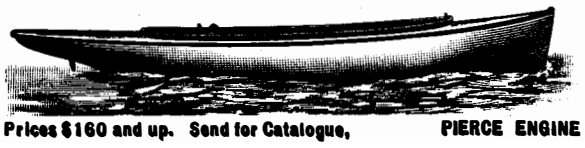

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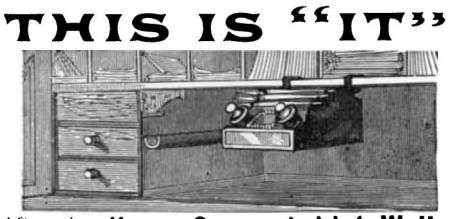

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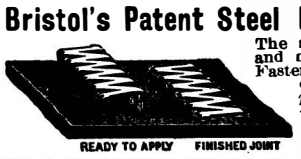

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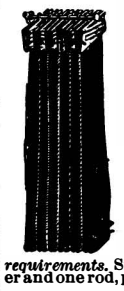

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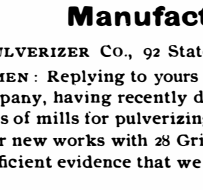

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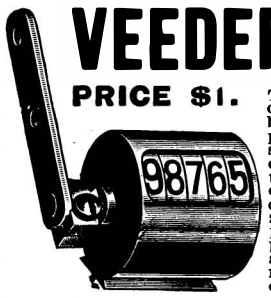

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